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[OFFICIAL NOTICE.]

Eighteenth Annual Meeting of the American Gas Light Association.

EXTRACT FROM THE CONSTITUTION:—Sec. 12. *Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.*

SECRETARY'S OFFICE, Aug. 25, 1890.

To the Members of the Association: Gentlemen—The rapidly approaching autumn serves to remind us that the time for the Eighteenth Annual Meeting of our Association is drawing rapidly near, and it is therefore proper that I should inform the members of the arrangements which are being consummated, whereby we hope the meeting will be made one of the most successful gatherings we have ever had; certainly it deserves to be such, for it will be the first time we have ever gone to the extreme South to hold our annual convention. Already there are indications that the coming meeting will be a very large gathering, and it is proper and natural that it should be; for as many of our Southern members have been very faithful in their attendance at our annual gatherings, when held at the North and in the West, it is but just courtesy that the brethren from the cooler sections of our territory should make an extra effort to be present on this first occasion of our coming together in the South. And, further, the South is a section of the country through which many of us have not traveled so thoroughly as we have in the North, and it is therefore but natural that we should all be only too anxious to improve this opportunity to make ourselves better acquainted with Southern people and the Southern land, for the novelty of the surroundings in the South will add a peculiar charm to our trip. Savannah is a typical Southern city, and one particularly suited for the holding of our convention. Situated on the south of the Savannah river, and within 12 miles in a straight line from the coast, it has many advantages of both an inland and seaboard city. The river in Tybee Roads has a depth of 31 feet at low water, thus admitting the ocean steamers to come up direct to the wharves of the city; hence it will be possible for such of our members living in the vicinity of Boston, New York, and Philadelphia, who enjoy an ocean sail, to take a steamer from either of the cities named and land right at the heart of the city.

Savannah is a very pretty city and has many attractions peculiar to itself; laid out as the streets are in rectangular lines, they are pleasantly broken by many small but pretty parks—in fact there are between 20 and 30 of these attractive gardens scattered throughout the city. In the southern part of the city is Forsyth Park, with a fountain after the model of that in the Place de la Concorde, Paris, and a monument to the Confederate slain. Johnson Square contains a doric obelisk of General Green and Count Pulaski, the corner stone of which was laid by Lafayette; and in Monterey Square on the spot where Pulaski fell, in 1779, rises a more elaborate monument—a statue of Liberty. Many of these parks are semi-tropical in their vegetation, and will have to many Northerners the charm of novelty; and in this connection should be mentioned Bona-Venture Cemetery, with its live oaks dressed in Florida moss—at once a beautiful and novel sight. It is also to be noted that Savannah is one of our largest cotton shipping ports, and our members will have the opportunity of seeing the loading of cotton vessels going on with all its hustle and bustle; the sight of men stowing away a cargo of cotton, with the help of huge jacks, will certainly be new to many of the visitors. We will also be fortunate this year in having hotel accommodations such as we have not had at any previous convention. The De Soto—the headquarters selected—is a new hotel and is a good rival of the magnificent hotels which have lately been built in the South. The De Soto occupies a prominent corner in the central part of the city, in fact covers the site on which—as old army men will well remember—stood the old arsenal used as the headquarters of the Union forces during Sherman's occupancy of the city, and is built in the form of a hollow square, in the center of which is the parade ground; the front of the building measures 222 feet, while it extends 302 feet to the rear; the dining hall, which is beautifully finished, is 44 feet by 120 feet, and looks out upon Liberty and Drayton streets on two sides, the windows of the third side opening out upon a veranda overlooking the parade ground and tennis courts. The service of the hotel will also be of the best; the committee of arrangements are giving this matter particular attention, and, as the house will not be at all crowded, members can depend upon finding everything thoroughly comfortable. The rate which has been secured at the hotel for the members of the Association and their friends is $3.50 per day, board included, with a discount from this price if the attendance is large. It is hoped that all the members will stop at the De Soto, because by so doing they will help to swell the number and thus aid in securing the lowest rate. It is to be remembered that though the rate is thus made very low—considering the character of the hotel—nevertheless the accommodations will be first-class and such as they would offer to their regular guests. It is hardly necessary to add

that private parlors and bath rooms will be charged for extra, as is the case in any American conducted hotel.

I have thus gone into a description of the hotel with more than regulation precision, because I fear some of the members may feel that as Savannah is not a city of the first magnitude, the hotel accommodations might be of an indifferent nature; whereas the fact is we may expect to be taken care of far better than we have been in the past, even in the largest cities. The meetings of the Association will be held in the spacious banquet hall on the top floor of the hotel; we will thus have both a cool and a quiet hall.

The meeting will be called to order by President McMillin, on Wednesday, October 15th, at 10 A. M., and will continue through the two following days. The papers already promised are as follows:

"The Extension of the Use of Gas for Purposes other than Illumination," by E. G. Pratt, of Des Moines, Ia.

"The Mismanagement of Gas Works," by E. G. Cowdery, of Milwaukee, Wis.

"Gas Coals of the United States," by H. C. Adams, of Philadelphia, Pa.

"The Practical Efficiency of an Illuminating Water Gas Setting," by A. G. Glasgow, of Philadelphia, Pa.

"Inclined Retorts," by Frederic Egner, of St. Louis, Mo.

From the above it will appear that we have already five good themes for special study and discussion, and we expect three more papers, the subjects to be announced later. In this connection I would say that if a member has any matter upon which he would like to write a paper, we can probably find room for one more essay. I would also issue my usual invitation for members to send in queries for the question box; it is well to have these in advance in order that we may have some one prepared to lead off in the discussion.

On the evening of Thursday, the second day of the meeting, the Association will be the guest of the Savannah Gas Company, at a banquet which will be given at the De Soto; it is expected that in addition to the members of the Association there will be present many of the leading citizens of Savannah to grace the occasion. Efforts are being made to have a river excursion on the last day of the meeting.

We expect to have the regular rebate on railroad rates, particulars in regard to which will be given later, when I have received detailed information from the railroad authorities.

I wish to impress upon the members that Savannah is easy of access from most of the large cities of our country; for instance, leaving Boston at 7 o'clock Sunday night, we would pass through Washington at 11 the next morning, reaching historic Richmond at 2.30 the same afternoon; an hour later we reach Petersburgh, ever famous since the war; Charleston we will see by the early daylight, and at 6.44 Tuesday morning we should be at Savannah. Or those who do not care to spend so much time away can leave Boston Monday night and reach Savannah a few hours before the opening of the convention. Leaving New York at midnight of Sunday or Monday, Savannah would be reached on Tuesday or Wednesday morning respectively; while the run from Philadelphia takes less than 24 hours. From Chicago one route is over Illinois Central to Cincinnati, thence by Queen and Crescent, Western and Atlantic and Georgia Central; time 39 hours. Time from Cincinnati, 34 hours. From St. Louis, via Louisville and Nashville, and Nashville, Cincinnati and St. Louis, and Western and Atlantic, and Georgia Central; time 34 hours.

Thus it is apparent that the run to Savannah from the centers, at which the members will be apt to congregate before starting South, is not a long one, and as the route much of the way lays through interesting sections of the country, with pine forests and beautiful rice fields, and through places made historic by the war, the journey ought to be a pleasant one. If the members desire to charter special cars, I will gladly help them in any way I can. Or those preferring an ocean trip can take one of the ocean steamship company's vessels from New York or Boston and land right at the city, the trip taking from 48 to 55 hours. The rate by this route, including meals and berth in state room—first-class—is, from New York $15, or $25 for the round trip; from Boston the rate is $17 one way, or $29 for the round trip. Those desiring to secure these special rates must obtain a proper certificate from me.

Finally, I wish to urge upon each and every member that he endeavors to be present and make this meeting a grand success. We meet for the first time in the South; we have for our President one of the most popular men of the West; these two facts should lead all to make an extra effort to attend. Not only so, but it is particularly desired that the members will bring their ladies with them, as the committee are making special arrangements for their entertainment. Already a local committee of reception has been appointed from among the hospitable ladies of the city, so there will always be escorts at hand to show the attending ladies the places of interest throughout the city, of which there are many more than I have space to enumerate. Anticipating the attendance of a large number of ladies, the hotel proprietors have placed at the disposal of the local committee of ladies the large parlors at the Bull street entrance of the hotel, and they will be for the exclusive use of the ladies attending the convention. In fact it may be said the entire hotel will be at the disposal of the members and their friends.

Yours truly, C. J. R HUMPHREYS, Sec'y.

LAWRENCE, MASS.

BRIEFLY TOLD.

THE CANDLE POWER OF ELECTRIC LAMPS.—If an honest confession is good for anything, then great good should result from the frank admissions made by certain members of the National Electric Light Association, during the occasion of their recent convention by-the-sea at Cape May. We refer to the "admissions" respecting the actual candle power of arc and incandescent electric lamps, as these are commercially supplied at the present day. Premising any further comment in the remark that the discussion on the "Classification of Incandescent Lamps," will be found on pp. 330 and 331 of our issue for last week, and presuming that it has been by this time carefully conned over by our readers, we have to say that Dr. Bell, of this city, who started the discussion, must be a man of great courage and possessed of a heaping fund of honesty, in coming out so flatly. He admits without hesitation "that of the various lamps" (referring to those of the incandescent type) "which are now in use, rated at 16-candle power nominally, some of them give the full candle power called for by their names," while "others give 10, 12, 14 or 15," etc. The true gravity of his statement will be better comprehended when it is remembered that the Doctor refers to lamps that have only just left the factory, and that the discrepancy is discoverable by the lighting companies in their tests for candle power before the lamps are put on the lines of the consumers. It would certainly be bad enough were the lamps to show such shrinkages after they had been in use up to a considerable percentage of their rated lives, but what excuse can be offered by either lamp maker or lighting company—the former to the latter, or the latter to the consumer—for placing on sale or putting in service, as 16-candle power lights, lamps that by actual test are known to be 37½ per cent. under their nominal value? It is fair to assume that the true answer to this question would not look very well in print. Mr. Alexander's contribution to the discussion also has the merit of frankness, and he further advances a reason for the discrepancy between actual and nominal candle power of incandescent lamps, in the remark, speaking about the photometric practice (save the mark) of a certain firm of lamp manufacturers, in whose shops "three little girls, who are paid from $4 to $7.50 per week, have to measure from 2,000 to 2,500 lamps on a photometer per day." The whole discussion discloses a very mixed condition of affairs anent the practice of rating the candle power of incandescent lamps, and should open the eyes of the commercial users of the same to the fact that they are more often than not paying very high rates for a very inefficient service.

THE LOOMIS PROCESS, FRAMINGHAM, MASS.—From time to time we have published in our item columns hints as to the progress of construction work on the plant of the new Framingham Gas, Fuel and Power Company, which is being carried on under the supervision of Mr. Wm. Tarbell. We can now say, through the courtesy of Mr. C. J. McPherson, President of the Company, that the plant is to be of the Loomis type, from which a non carbureted water gas is to be supplied; and that incandescent burners will be depended on to make the gas available as an illuminating medium. The rates adopted are as follows: Gas used solely for lighting purposes, 90 cents per 1,000 cubic feet, with a discount of 15 cents for prompt payment. Those who use it for lighting, cooking, heating and power purposes are to be charged 60 cents per 1,000, with a discount of 10 cents for prompt payment. Special rates will be granted to large users. Mr. Tarbell insists that the works will be completed and in operation on November first—the time specified in the contract—and that the success of the Company is assured.

FUEL GAS FOR BOSTON, MASS.—From a circular just to hand (bearing the signature of Mr. F. P. Addicks, Treasurer), we learn that, commencing on November 1st, the Boston Gas Light Company will supply a fuel gas, to be used solely for fuel purposes, to consumers resident on the following named streets, special mains for such delivery having been laid: Endicott street, from Causeway street to Cross street; Cross street, from Endicott street to Haymarket square; Haymarket square; Union street, from Haymarket square to Dock square; Dock square; Adams square; Cornhill, from Adams square to Scollay square; Scollay square, and Tremont street, from Scollay square to Eliot street. From this it will be seen that this attempt at fuel gas distribution is much more than a mere experiment, in that a fairly large district is to be supplied. The estimated calorific value is 400 heat units to the cubic foot, and the net rate at which it is to be supplied is 60 cents per 1,000. The Company promises, if this trial discloses a fair public demand for the gas, to eventually supply the whole city. The results will be eagerly looked forward to by the fraternity.

The Gas Industry and Ice Making and Refrigerating.

By Mr. Milliam Mooney, C. E.

Among what may be called the bye-industries connected with coal gas manufacture is the comparatively new one of ice making, and, in connection with it, the business of refrigerating. Nature has been so fickle of late years in the manufacture of the natural article that no dependence can be placed upon an annual supply. The transportation of meat, fruits, etc., and perishable goods and their storage has so greatly increased the demand for ice that this business has grown to large proportions, and is still increasing rapidly.

During our late extraordinary open winter it is safe to say that no ice was harvested within 100 miles of New York city. This unusual scarcity of ice has greatly stimulated the business of its manufacture, and also that of refrigerating or cold storage.

Those already in the business can supply but a very small quantity of the ice demanded of them, and the makers of refrigerating apparatus and ice machines are taxed to their utmost capacity. At present the manufacture of ice is really but a small part of the business, as the use of ice is dispensed with in the cold storage rooms and refrigerators, the temperature being lowered to any required degree by the circulation through pipes of a non-freezing mixture which has been deprived of its heat in its passage through the refrigerating apparatus.

At Washington market, in this city, the refrigerators are kept cool by the circulation of salt brine, which, after circulating through a great number of boxes and cold storage rooms, returns to the brine tanks, still with a temperature below the freezing point, this being shown by the heavy coat of ice which incases both outlet and inlet pipes.

A very small coil of pipe is enclosed in a box on top of the refrigerator, and an inspection of this coil shows it to be continually encased in a solid mass of ice.

One improvement yet to be made is the controlling, in some way, of the water condensed from the atmosphere, which, although the pipes are heavily felted and boxed, gives considerable trouble. The price charged for this service is based on the cubic foot of refrigerative capacity, and is much less than the cost of ice would be for the same purpose.

The relationship of this industry to coal gas manufacture comes through the use of the well-known bye-product, ammoniacal liquor, liquid ammonia being the agent used by all machines for the reduction of temperature.

It is well known that the compression of any substance is attended by heat, or an elevation of the temperature; and, *vice versa*, expansion will produce cold, or a reduction of the temperature. It is upon the lowering of the temperature by the expansion of compressed gas that the refrigerating and ice machines are based.

Other materials have been tried, such as air, ether and alcohol as refrigerating agents, but liquid ammonia is by far the most efficient, not only on account of its ready vaporization at a low temperature, but also because its power of absorbing heat in that change is but little inferior to that of air.

Two different systems are used in the business—the compression system, and the absorption system—the former using anhydrous ammonia, and the latter liquid ammonia, which is first converted into anhydrous ammonia, and afterwards, by a heating or absorption process, again turned back into liquid ammonia.

In the compression system steam engines of heavy horse power are used to drive the compression machines and pumps, but the absorption system requires no machinery except the pumps, although the apparatus is more extensive than in the compression system.

The process by the compression machines is, briefly, as follows: The anhydrous ammonia is expanded, as in the absorption process, in a tank containing a coil, through which is continually pumped a non-freezing mixture, which, in this process, consists of salt brine. After the ammonia vapor has extracted the heat from the brine, it is passed through condensers cooled by water, and again compressed by compressors, to be expanded as before. The process is continuous, and the ammonia is used over again, having to be renewed only about once a year.

In the absorption system the liquid concentrated ammonia is vaporized by a steam coil in a generator, the vapor, under a high pressure, passing through a kind of frictional condenser, called an analyzer, which deprives the ammonia of its water, making it anhydrous. The vapor is then cooled by passing it through a condenser, the cooling agent being water. The anhydrous ammonia, which is held under high pressure in a vessel called the receiver, is now ready for its work. Adjoining the receiver is a tank or cooler containing a coil of pipe, through which circulates the non-freezing mixture, which, in this process, consists of a solution of chloride of calcium, which freezes at a temperature below 0° F.

This tank is connected by a pipe with the receiver containing the anhydrous ammonia, and, upon opening a cock on this pipe, the ammonia is expanded to many times its former bulk, accompanied by intense cold.

The heat in the non-freezing solution is thus extracted, as it passes through the coil, and it is pumped through pipes either to the refrigerating rooms or to the ice tanks.

After the expanded vapor has extracted the heat from the brine, by contact with the coil through which it passes, it is brought in contact with the hot, weak liquor in the generator and again converted into liquid ammonia, and passed through the generator and analyzer as before.

In the ice tanks the coils containing the cold brine circulate through the brine in which the moulds holding the water to be frozen are immersed. The ice is made into cakes of a size easily handled, and as there is no cutting, there is very little waste.

In making ice for refrigerating purposes ordinary water is used; but for making ice for other purposes, distilled water is used, which also makes a denser and better article.

A large field for the extension of this business has been found in fitting up cold storage rooms on ocean steamers, particularly those sailing to ports in tropical climates.

In the rapid extension of this industry the eye of prophecy may see our city dwellings heated in winter and cooled in summer by the same set of pipes, and indirectly by the same agent—steam.

As a factor in the cheaper production of coal gas, the effect of the increased use of ammonia will soon be felt, and upon the expiration of existing contracts much higher prices will be obtained. Many small works will also find a profit in concentrating their liquor, where it is now thrown away as a worthless product.

[Continued from Page 330.]

Notes on Gas Lighting and Gas Fitting.

By Mr. William Paul Gerhard, C. E.

[Reprinted from *Building*, which obtained permission from the author for its publication.]

Next, great care should be exercised in every household in the use of matches for lighting the gas. Matches should always be kept in closed earthen or metallic vessels or boxes, and it is a wise precaution to provide a second receptacle to receive burnt matches. Matches must be kept out of reach of children, as well as rats and mice, which latter seem to have a special preference for phosphorus, and often carry matches into hiding places under floors or behind baseboards or wainscoting, and cause the matches to ignite by gnawing at them. So-called parlor matches of wood or wax are particularly dangerous, as they easily ignite by friction. The better class of safety matches which can only be ignited on specially prepared surfaces are much better. For lighting chandeliers wax tapers are preferable to matches. A still better, more convenient and safer arrangement for lighting up gas consists in the use of portable safety lighters, either mechanical or electric torches. The best method is, undoubtedly, a well-arranged system of electric gas lighting with automatic or pull-burners; and it is recommended, in building new houses, to wire all gas outlets for it.

Other precautions against fire relate to the construction and location of gas fixtures. All side or bracket lights should be kept at a safe distance from windows, doors, or other inflammable woodwork, and from curtains, portieres, lacework, or other hangings. Lights in exposed positions should always be inclosed in glass globes, because strong drafts of air will sometimes blow unprotected flames sideways, very far endangering combustible objects near by. Swinging or folding bracket lights are particularly dangerous, and should be avoided wherever possible, particularly on stud partitions or cabinet woodwork, and rigid brackets should be used instead. If swinging gas brackets must be used, they should be fitted with guard rings of large diameter. Even fixed bracket lights should never be so placed that an opening door would come into contact with the gas jet.

Portable gas fixtures connected with rubber tubing to a wall gas outlet are also, to some extent, dangerous, and must be handled with care. There should always be a distance of 3 feet between all burners and the ceiling or woodwork, and in places having low ceilings, metal, glass, or porcelain bells or shields should be hung over the flame to protect inflammable ceilings, and incidentally to prevent the ceiling from becoming smoky, owing to accumulations of small particles of unconsumed

carbon. If shields are used the minimum distance between burner and ceiling should be 18 inches.

In basements, and in the servants' departments of a house generally, such as the kitchen, laundry, ironing room, linen closet, wardrobes, and all other places where inflammable articles of wearing apparel may come into contact with gas jets, or where in stores or warehouses much material of a combustible nature is handled, strong and large round metal wire cages, guards or screens, at least 10 inches in diameter, and with close meshes and so shaped and constructed that any combustible material coming in contact therewith shall be out of reach of the flames, should be fitted and attached to the gas bracket in a firm manner—preferably soldered.

In case many lights are suddenly turned out, it often happens, especially on the higher floors of buildings of many stories, that a single flame left burning jumps up or flares, generally with a whizzing or singing noise, due to the temporary excess of pressure, to such a height that it may set woodwork on fire. The same sudden flaring up of a gas jet may occur when a lava tip cracks or breaks off. As we will see later on, pressure regulators—or, better still, governor burners—will prevent this occurrence.

After this slight digression relating to fires directly or indirectly caused by gas lighting apparatus in houses, we will continue our consideration of the proper means for obtaining a satisfactory gas light illumination.

We have given, therefore, as concisely as possible, the requirements of a good gas piping system. The next point requiring attention is the burner at which the gas distributed by the pipe system is ignited and consumed, giving off light. In order to have a better understanding of the requirements of a good burner, it is necessary to say a few words relating to the composition of illuminating gas, and the mode in which, by combustion, it is turned into a light-giving flame.

Lighting gas is a very complex mixture of gases, of which various chemical compounds of carbon and hydrogen—the hydrocarbons—form the chief light-giving constituents. Gas always contains more or less impurities, the principal ones being carbonic oxide, carbonic acid, ammonia, sulphureted hydrogen, and bisulphides of carbon. These are partly removed by purifying processes before the gas leaves the works.

When a gas jet is ignited the inflammable hydrogen is consumed in the lower part of the flame, producing sufficient heat to render the infinitesimal particles of carbon incandescent. The hydrogen in the process of combustion combines with oxygen from the air, forming an invisible vapor of water, while the carbon unites with oxygen, forming carbonic acid. Hence we see that the products of combustion of perfectly purified gas, when perfectly consumed, are water and carbonic acid; but in reality it is seldom that gas is so perfectly purified and that combustion is perfect. The carbonic acid of unpurified gas reduces its illuminating power, and the other gaseous admixtures (chiefly compounds of sulphur) are converted by combustion into harmful vapors injurious alike to the human system when inhaled, to house plants, and finally to the interior decorations of houses.

Various reasons tend to render combustion incomplete. There may be excessive pressure of gas, and there may also be lack of air to the flame, and finally the burners may be defective. The pressure in the street mains must necessarily be somewhat higher than required in the house services, on account of the differences in the street levels of a district. An excess of pressure at the burners causes a reduction of the amount of illumination, and it becomes desirable to reduce the pressure, which can be accomplished by several means, to which we shall refer below. On the other hand, it may happen that the pressure is insufficient, and in that case the heat of the flame will not reach a degree sufficient to raise the carbon to white heat, and the result will be that the flame smokes. It follows that for every burner there is a certain amount of pressure and corresponding flow of gas which will cause the brightest attainable illumination. It is found by experience that gas should be burned at the lowest practical pressure consistent with adequate supply; and where the size of the meter and the diameter of the house distributing pipes and of the tubing of gas fixtures is ample, the intensity of illumination will depend chiefly upon the conditions under which gas is burned.

As a rule the gas pressure at the burners is excessive, particularly in the upper stories of houses located on high ground. Too much pressure is readily detected by the hissing or roaring sound of the gas flame. The result of incomplete combustion is a waste of gas, it being stated by good authorities that, as usually burned, from 20 to 50 per cent. of the gas registered at the house meter is actually wasted. This waste is very objectionable, first, because it causes high bills to the consumer; second—and this is of vastly more importance—because it contaminates the atmoshpere of the house, and thus injures the health of the inhabitants; thirdly, because the injurious compounds of sulphur due to incomplete combustion of gas are destructive to furniture, bookbindings, wall papers, picture frames, decorations, and gilt work, while the smoke incident to imperfect combustion blackens ceilings and walls.

It seems deplorable that the gas companies, with perhaps a few exceptions, do not show any interest in making efforts to stop the waste of gas in houses. What they are chiefly concerned in are the gas leaks at the works, in the street mains, and at the connections of the house services with the main; and the fact that all such leaks constitute a direct loss to the company, and not to the consumer, may perhaps be taken as a sufficient explanation.

The waste of gas due to incomplete combustion is still further increased by the use of defective burners, the best of them after some years becoming worn out and imperfect. It is therefore desirable to use the greatest care in the selection of proper burners, by paying due regard to their construction, material, size, and shape. It has been ascertained by carefully conducted experiments that poor burners give only from 20 to 50 per cent. of the light which can be obtained by the consumption of a given quantity of gas under proper conditions.

The Adams Coke Oven.

The *American Manufacturer*, in describing the mode of construction and method of operation of the Adams coke oven, says that the inventor aimed to improve upon the standard bee hive oven, the form and character of product of which is too well known to require special comment here. Suffice it to say it is the oven universally used in the great Connellsville region, whose coke has become the standard for comparison throughout the country, and for purity and general excellence is not surpassed in the world.

The great drawback to the bee hive oven has been the labor of drawing the charge after the coking was completed, but the superior quality of the coke has outweighed this disadvantage, and the bee hive type of coke oven still holds and is likely to retain its place as the most superior oven known, everything considered. The oven the subject of this article is one devised with a view of retaining the good points of the standard bee hive oven in the matter of form, convenience of building and quality of product, and at the same time to overcome at once the serious disadvantage of the old type of oven in the matter of labor in drawing the charge, consuming, of course, much time—some 3 hours—and entailing a great waste of heat in the walls of the oven, which it would be desirable to save and have available in beginning the work of coking the new charge.

The improved oven consists essentially of a bee hive oven having a movable bottom balanced and resting loosely upon a vertical ram, by which, when the charge is coked, the bottom of the oven may be lowered onto a truck which is run under the oven, and the ram being still further lowered, the truck is drawn out upon the wharf, the coke quenched, pushed from the oven bottom, the truck with the oven bottom run under the oven, the bottom returned to its place, and another charge put in, the whole operation of drawing the coke and preparing the oven for another charge not occupying more than 15 minutes.

The arrangement of the various parts of the oven and the manner of operating them will be readily understood from an examination of the accompanying illustrations. Fig. 1 represents a section of the oven cut through the mouth of the oven *H* from *C* to *D*, together with a sectional elevation of the bottom *F* (Fig. 2) in place, having been raised to its proper position by means of the hydraulic ram *g* (Fig. 1). This ram stands in a pit *i* (Fig. 1), directly under the center of the oven. The ram is 6 feet in length, works in a cylinder *h* (Fig. 1), and has a rise and fall of 5 feet in operating the bottom. The head of the ram *e* (Fig. 1) is an iron plate 4 feet square. From the center of this head protrudes a frustrum *f* (Fig. 1), which fits into an opening of similar form in the bottom as shown in the cut (Fig. 1).

The bottom proper is made of ¼-inch wrought iron cut into sections to form the circle. These are riveted to stays or supports *c c* (Fig. 1) made of H iron. The iron is first split from flange to flange, and when riveted to the plates or sections of wrought iron forms a complete web of 5 inches in diameter at the center of the H iron *c c* (Fig. 1), and tapering to nothing at the outer edge of the bottom, as seen in Fig. 1. The bottom has a 3-inch concave.

Around the outer edge of the bottom is riveted angle iron *b* (Fig. 1), and the entire bottom inlaid with 1 layer of brick. A square plate of wrought iron *d* (Fig. 1) is also riveted to the web as shown in Fig. 1. In the center in this plate, and continuing through the web to the plates of the bottom, will be seen the opening or tapering receptacle (Fig. 1) to re-

ceive the frustrum of the ram head, the object of the ram head, the frustrum and the opening in the web being to add stiffness and stability to the bottom while the coke is being removed.

In operation the small 4-wheeled truck shown in section in Fig. 2, upon which the bottom of the oven is lowered, is pushed along the track (Fig. 2) until it is beneath the oven and directly over the ram, the hydraulic pressure then being applied. The ram rises from the cylinder, passes through the frame of the truck, and the frustrum of the ram head entering the hole in the web exactly balances the bottom. The bottom is thus raised till it touches the shoulder of the oven *p p* (Fig. 2), when 2 legs or supports, hinged to the under part of the oven bottom,

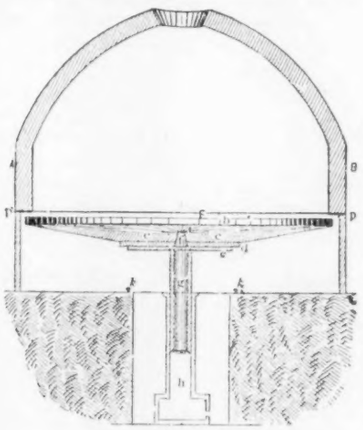

Fig. 1.

are dropped, and hold the bottom firmly to the shoulder. The bottom then occupies the same relative position as the bottom in the ordinary bee hive oven. The bottom having been fastened to its place, the ram is lowered into the cylinder, the truck removed from beneath the oven, and the doors *T T* (Fig. 3) are closed. The oven is now ready for a charge of coal.

The charging is done in the ordinary manner, and the coking completed, the operations described in the preceding paragraph are reversed and the coke drawn in the following manner: The truck is run under the oven, the ram raised to a sufficient height to support the bottom, the other supports are withdrawn, enabling the bottom to be lowered to the

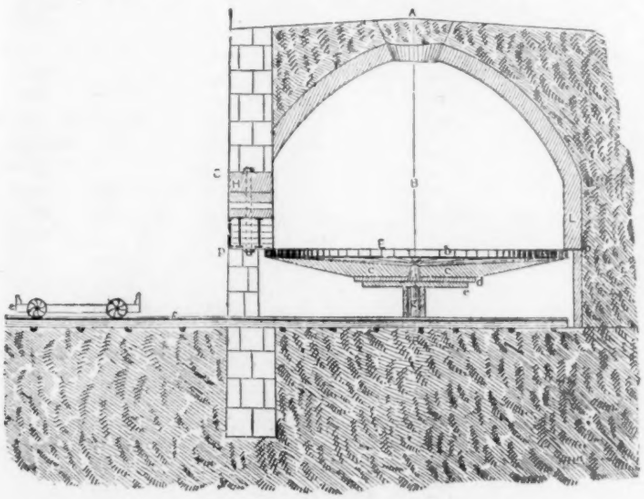

Fig. 2.

truck and run out upon the wharf, where the coke is watered before it is disturbed in position in the least. After the coke is quenched it is pushed from the oven bottom, which latter is then returned to its place in the manner above described.

The manner of quenching coke made in the Adams oven differs materially from the ordinary practice with the bee hive oven, this operation being with the Adams carried on *outside* the oven, a spray from a revolving nozzle being used for this purpose. By watering the coke in this manner it is claimed that fully as good results are obtained, so far as the quality of the coke is concerned, as in the ordinary method of quenching inside the oven, and at the same time a great advantage is gained, for the red-hot walls of the oven are not cooled, and of course this cause of rapid deterioration of the ordinary oven is avoided. It will be seen from the foregoing that all wear and tear on the ovens in drawing the coke incident to the use of hand tools for this purpose is dispensed with. Further, the number of tools necessary in the operation of a plant of ovens is very much less than with the bee hive oven, those necessary for a plant of 25 Adams ovens being only one hose, one chain, shovel and leveling scraper, as compared with three hooks, one fork, one hose and a wheelbarrow to every four bee hive ovens, and requiring with any plant of considerable size the services of a blacksmith to keep the tools in order.

In practical tests which have been made of the working of this oven it has been found to coke coal successfully in 24 hours. This gain in time over the bee hive oven is largely due to the fact that the oven does not cool off to any appreciable degree during the operations of drawing the coke and recharging.

The following figures, showing the economy of this oven over the old form of bee hive oven, are given on the authority of Mr. J. B. Anderson, of this city, General Manager of the Adams Coke Oven Company:

Bee hive—Size, 12 × 7; capacity in cubic feet, 113; average charge of net tons coal, 6.14; average net tons of coke produced, 4; yield, 65 per cent.; times drawn during week, 3; cost per net ton of drawing, .21¾; time of drawing oven, hours, 3; average amount of coke produced per week, net tons, 12. Adams improved—Size, 12 × 7; capacity in cubic

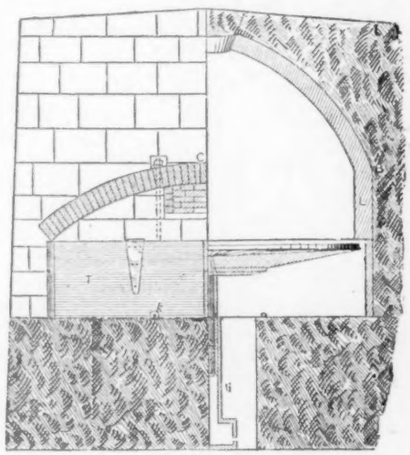

Fig. 3.

feet, 113; average charge of net tons coal, 3.85; average net tons of coke produced, 2.5; yield, 65 per cent.; times drawn during week, 6; cost per net ton of drawing, .06½; time of drawing oven, hours, .15; average amount of coke produced per week, net tons, 17.

The ultimate saving in the use of these ovens will appear in the following comparison, assuming for the same a plant of 100 ordinary bee hive ovens and a sufficient number of Adams ovens (71) to have the same output. In the Connellsville district the operation of a plant of 100 bee hive ovens for 1 year will cost, including interest on investment, repairs and labor, very close to $20,150, which, divided by 60,000, the tonnage of output gives 33.58 cents as the cost per ton for coking alone, using the bee hive ovens. The cost of operating a plant of Adams ovens of equal capacity, based on the figures given above, including the same items as mentioned in connection with the bee hive plant, would be $11,510, or 19.18 cents per ton of output, a saving of 14.4 cents per ton, or $8,640 per year.

The objection to these ovens in the matter of the machinery necessary in their operation may be met by the fact that water is not used inside the walls of the oven in quenching the coke, and which it is believed will, because of the greater durability of the oven thereby secured, fully compensate, by the saving in cost of repairs, for the increased cost of construction.

Further, dry coals can be coked in this oven which cannot be made into coke with the standard bee hive oven, experiments which have been made with the "Leamon" coal proving this quite conclusively.

The appearance of the coke, which is bright and silvery, and the almost entire absence of small coke made, give additional evidence, if any be needed, in proof of the claims made for this oven, that it is fully the equal of the standard bee hive in every respect, and its peer in some.

The successful operation of these ovens, both from a mechanical and financial standpoint, seems to be assured, and it is to be hoped they will receive the recognition to which, judging from their merits, they are entitled.

The Provincial Gas Manager.

The London *Journal* makes the following well-timed and apt remarks representing the position of the provincial gas manager, many of which apply with force to the managers of small gas works in this country. Our contemporary says:

There are many positions more enviable than that of a gas manager in a small provincial community. Whether he takes service under a company or under a corporation or local board the result is apt to be much the same. In either case he is subjected to many little annoyances, in themselves frequently trivial enough, but calculated in the aggregate to make a grievous total of toil and trouble. The engineer in charge of a large and well-equipped works has difficulties which are by no means to be despised. Men, as we have lately learnt, are not always tractable; stokers will strike, and coal famines occur; consumers, alas! are hard to satisfy; and the best laid schemes are apt to miscarry in a woeful manner. Big undertakings entail corresponding responsibilities; and the man entrusted with the guidance and control of any large enterprise is assured of abundant cause of anxiety. But, after all, he is free from some of the cares which beset the path of the manager of a small country gas works. A large and flourishing business of any description is rarely hampered by false notions of economy. The fact is rightly recognized that the way to make and to save money is to lay it out wisely and judiciously. Hence the engineer of a large works does not find it necessary to spend the summer in speculating upon the chances of his getting through the next winter without mishap, or in inventing little contrivances to make the worn-out, old-fashioned plant do duty for another year. When the dull days and long dark nights come, he can rely with perfect certainty upon the sufficiency of his manufacturing plant, and need not fear the grounding of his gasholders or the sudden extinguishing of all the lights in his district. With many provincial managers the case is different. They are happy if the various departments of their works are in any degree capable of responding to the demands made upon them. It would not be difficult to point to towns where the solitary retort house affords barely space enough for the necessary benches; where the purifiers (put in when the works were built half a century ago) are wholly insufficient to deal with the present make, and where the storage is altogether out of proportion to modern needs. Under such circumstances, the lot of the manager is not to be envied. A succession of unusually dark days in midwinter fills him with despair; for as he watches the gradual diminution of his stock of gas, he realizes that all the resources at his command will be utterly inadequate to maintain even a minimum presssure in the mains when night really comes. There is said to be a manufacturing town in the North where the gas supply fails with such remarkable regularity, that the local newspapers have a head line referring to the event constantly standing. It is in a district as liable to fogs as London itself; but the governing body of the town learns nothing from past experience, and every recurrence of the dismal plague finds the overstrained resources of the gas works unable to keep pace with the demand for more light. Plans for new and larger works have been under consideration for a decade; successive managers have urged the necessity of enlarging the provision for storage; but all counsel has fallen on deaf ears, and next winter will find things no better than they were last. Consumers grumble when the familiar burner temporarily ceases to yield the accustomed light; and they are compelled to make up the deficiency as best they may by the use of candles and lamps. Workpeople and manufacturers are alike aggrieved by the temporary suspension of labor in the factories of the place. Indignant letters are addressed to the local editors, and stormy scenes occur in the Council Chamber. But it is all forgotten in a day or two; and nobody seems to care about what has passed—except the gas manager who is in constant dread, so long as the winter lasts, of a repetition of the trouble. The corporation of the town is perhaps more than usually short sighted. It declines to incur the expense of a new holder because fogs do not come on every day. Inconvenience is caused by the present arrangements; but then a gasholder would cost a lot of money, and it is not required all the year round. And so things are to go on as they are. Large and important manufactories in the district may be disorganized by forced stoppages; business arrangements of all kinds may be wholly dislocated; the gas manager may be unnecessarily worried; and the expansion of the business of his department checked and hindered. Nevertheless the corporation remains contented; and the holder has yet to be ordered.

But this is by no means the only nor the worst trial of a provincial gas manager. There are many men who would be content if they had nothing more to trouble them than the want of the necessary appliances for the comfortable and regular performance of their duties. Some have to endure much from those who are temporarily placed in the position of their employers. Everbody knows the man who, "dressed in a little brief authority," has the happy knack of making things uncomfortable for all around him. He is to be found in every community. Brusque, impetuous, ambitious, and noisily self-assertive, he gets into office as a member of the corporation or local board, and then, unless controlled by stronger wills than his own, assumes a dogmatic and offensive tone, and displays equal readiness to teach the gas manager the art of making gas as the surveyor that of mending roads. As a friend, he is an unmitigated nuisance; while as an enemy, he is dangerous and not lightly to be crossed. Unfortunately, he is much more likely to be the enemy than friend of any public servant who conscientiously strives to do his duty. For your local patriot, the ardent democrat and friend of the masses, usually has his own little "axe to grind." Anxious as he is to safeguard the interests of his constituents, he seldom loses sight of the fact that he has interests peculiar to himself which are of far greater importance. If he owns property, he wants the street in which it is situated to be better lighted and better paved and cared for than any other. If he has relatives, he is ever on the watch to find them public appointments, or to put a little business within their reach. So long as he succeeds in having his own way in such matters, he is as mild as a sucking dove, and his good friends the public officials are only a little less perfect than angels. But it occasionally happens that his demands are too exacting and his wants too large to be complied with. A change then comes over the hitherto blissful scene; and the official who has dared to have a will of his own is caused to feel that he has made a foe of his once very good friend. Little difficulties of an unexpected nature spring up in his path; fault is found with arrangements which have previously been deemed entirely satisfactory; doubts are raised here, fears expressed there, until the offender is made to realize that he is living in an atmosphere of wholly unmerited suspicion, and must either resign or live on in perpetual dread of dismissal. Troubles of this kind press with double weight upon the men in the smaller districts who hold dual appointments. He who is at once gas manager and clerk to a local board, or combines the duties of gas manager and surveyor, has many more points of contact with these self-seekers than any who occupies but one post. The opportunities for differences of opinion are thus multiplied, and the difficulty of avoiding some cause of quarrel is increased. Take the case of a corporation, situated—well, never mind where. The gas manager is the servant of the town council, and discharges also (let us say) the duties of sanitary superintendent. It is really an extensive and populous district, with gas works requiring an average amount of attention and supervision, and with an abundance of work in the sanitary department. Some time ago, indeed, the Local Authority deemed the duties of the latter position important enough to require a special and well paid officer to discharge them. They are now combined with the duties of the gas manager, who has the satisfaction of doing double work at the original remuneration, and without assistance of the slightest character. The economical gentlemen who manage the affairs of this little Utopia have, indeed, cut matters so very fine that there is not even a clerk to copy a letter or a boy to take it to the post when written and copied. Matters nevertheless went along pretty smoothly until it happened that the views of the sanitary superintendent with regard to certain improvements clashed with those of a member of the corporation who had an interest in the property needing reform. Since then, neither the gas manager nor the sanitary superintendent has done right; and it is possible that the ratepayers of that district may lose an able, conscientious, and hard-working servant, and that he may be driven against his will to resign a position to which, in spite of the hard work, he had become attached.

Mention might be made of other troubles which fall to the lot of the provincial manager. One, shared by his "big brother," is that of being roundly abused for having the temerity to resist the demands made from time to time by the self-elected leaders of the workmen. This is by no means a serious matter, for strong language, or even bad language, does not hurt, though it is perhaps not altogether pleasant for a man to know that his actions are being misrepresented, and himself and all his relatives held up to public scorn and contempt in the little local market place. The chief trouble in such cases arises from the fear that the directors or the committee may not stand by the servant who is fighting their battle. With members of corporations and local boards there is a strong and perhaps natural tendency to lean to what they may consider the popular side of any quarrel; and the manager is not to be envied who, in such a crisis, finds himself deserted by those who should be his warmest supporters. The difficulty a good man frequently finds in getting adequate recognition of his merit is common to all professions. The plums are few, and there are many ready to claim them. If a man is

modest and retiring, he is liable to be jostled to one side by those who are more enterprising and persevering than himself; and he may grow grey and old without experiencing a feeling of the joy which comes from the consciousness that his labors have met with the reward they deserve. In some cases, even where the recognition does come, it is bestowed so niggardly, and in such a grudging spirit, that a taste of bitterness is left behind. This is frequently the case where popularly elected bodies have the control of large undertakings. Many men who fill public offices pride themselves solely on the "economy" of their administrations, and starve both the works committed to their care and the servants whom they engage. The so-called gain arising from this niggardly policy is, as we have frequently pointed out, more than counterbalanced by loss in other directions. But they cannot be induced to see it; and the starvation process is likely to exist to the end of time. It is, however, hard on a class of men who, by education and training, are often qualified for better things, and on whom the slightest departure from the path of rectitude is visited with terrible effect. A little more generosity and a somewhat broader view of all questions would vastly improve that democratic and popular government which is at once the pride and the danger of these times.

[Read before the Annual Meeting of the National Electric Light Association.]

The Dangers of Electric Lighting.

By Prof. Henry Morton.

When the development of electric currents on a large scale and at a small cost, first became possible by reason of the discoveries of Faraday, Wilde, Gramme, Siemens and others, the question of the dangers to life and property attending their use was brought prominently before the public: just as the dangers attending the use of steam, of rapid locomotion on railroads, and of dynamite, were brought to the attention of the world when these powerful agencies first left the experimental laboratory of the chemist or engineer, to take their part in the ordinary labor and business of life

In each instance alike there was a class of people who took the narrow and impartial view that if an agency was dangerous it should be excluded altogether from public use or what amounted to the same thing, be surrounded with such exclusions and limitations as would rob it of nearly all its capacity for usefulness, and restrict all possibility of advance and developement in its application.

Thus laws were actually passed in England, on the first introduction of steam, limiting the pressure in boilers to 30 pounds on the square inch.

The first railroad charter contained a clause limiting the speed of trains to 12 miles a hour, and when a speed of 30 miles was suggested it was ridiculed in a prominent journal of the day, as an idea simply insane, and it was said that people would just as soon be persuaded to allow themselves to be fired out of cannon as to be hurled along at such fearful velocities, which would without doubt have the most disastrous effects upon the circulation of the blood and other vital actions.

Some of us can also recollect the excitement produced and echoed in the press, on the introduction of dynamite, and the stringent laws regarding its transportation, which in many cases only increased the danger to the public by occasioning its surreptitious conveyance in passenger and ordinary baggage cars.

We shall have to be very young indeed not to remember the great popular excitement brought about by the daily press when electric lighting first appeared in the streets of New York, and when flashes of flame were described as proceeding from a horse that had run against an electric wire.

In all the older instances matters have settled themselves in accordance with the laws of human progress and the diffusion of intelligence, and we now have boilers running at pressures of 140 pounds and upward, trains going more than a mile a minute, and gunpowder largely superseded by dynamite.

What is more, the accidents and injuries actually produced by these several agencies have been vastly less than those caused by the things which they replaced.

A much smaller number of people are killed or injured by high pressure boilers than by low pressure ones. How rarely do we hear of the explosion of locomotive boilers which usually carry 140 pounds' pressure?

The accidents to express trains are as nothing compared to those occuring with freight trains, and the loss of life and injury to passengers by rail, is insignificant in its percentage to the number carried, when compared to similar loss and injury incurred in the days of stage coaches.

The same relation has been found between dynamite and gunpowder, the former having largely reduced the proportion of accidents and injuries compared with the work done. Two lessons are very plainly taught by the facts of history above alluded to:

1st. The world is not going to be frightened away from a new and valuable source of power by the circumstance inseparable from the very nature of all powerful agencies, that it is dangerous if not adequately controlled; but on the contrary will develop the new power to an ever-increasing and therefore more (possibly) dangerous intensity.

2d. Intelligently managed and controlled, and therefore, in a sense, dangerous agencies, become the most efficient protectors and servants of man, and not only aid him in his mission of subduing and utilizing nature, but actually protecting him in his work.

Without the "dangerous" agencies, man would be reduced to the lowest condition of savagery where he would be at all times helplessly at the mercy of the "elements" or the blind forces of nature.

With them he not only defies and subdues the beasts which would otherwise be his superiors, but even conquers and renders tributary to his comfort and advancement those vast forces which control the entire matter of the universe.

Applying these lessons taught by the great history of the world in parallel cases to the problem of the distribution and use of electricity, we see in the first place that the way to deal with its dangers ought not to be the timid, obsolete way of prohibition, or of unintelligent restriction, such as that which proposed the exclusion of locomotives from railroads or the limiting of their speed to 12 miles an hour; but the sensible way of providing adequate safeguards to the new power and with these allowing it to follow its natural line of development and growth into higher and higher ranges of intensity and consequent efficiency.

It is too well known to all, to need statement, that the methods thus pointed out by history and taught by experience, have not been by any means universally advocated or followed, and that while many have loudly demanded the exclusion of powerful electric currents the limitation of their intensity to what they suppose to be necessarily harmless ranges, the users of such electric currents have in too many cases neglected the most obvious precautions.

It is only fair to say in explanation of this latter statement that this neglect has in many cases been brought about by obstructions thrown in the way of good work by those who were exciting themselves for the total abolition of dangerous currents, and who like certain "total abstinence" advocates, objected to every mitigation of the evil they attacked, because any such improvement weakened their case against it.

As regards dangers to property from fire, the matter fortunately fell at an early period into the hands of the Board of Fire Underwriters, who in a judicious and business-like way investigated the subject, and formulated such rules as have proved eminently satisfactory, and have proved that under proper regulation as to good work and means of protection, electricity is by far the safest means known to us for the distributing and development of light, so far as fire-risks are concerned.

In view of the satisfactory results thus obtained I regard it as a fortunate circumstance that the other part of the problem, namely, that relating to dangers to human life, has been recently taken in hand by a similar organization known as the Employer's Liability Assurance Corporation.

This association, after collecting a mass of material from a great variety of sources, has some time since formulated a series of rules for the protection of those employed in erecting and operating electric apparatus involving the use of powerful, and, therefore, dangerous currents. These rules have been examined and approved by several of the managers of prominent electric companies, and so far it would appear as if no accidents have resulted from the use of electric currents where these rules have been followed, and that most if not all the accidents which have occurred would have been prevented had these rules been followed and obeyed.

Having had something to do with the framing of these rules it is my chief object in presenting the present paper to secure their criticism by those best able to perceive their imperfections, and such suggestions as may lead to their beneficial modification or extension.

I therefore quote them as follows:

"1st. Do not touch or handle any electric wire or apparatus of any sort while standing on the ground or while in contact with any iron work, gas or water pipe, or stone or brick work, unless your hands are covered with rubber gloves, and you are provided with such properly insulated tools as have been declared to be safe and in good order by the electrician or other competent officer of this company.

"If it is at any time necessary to stand on the ground, or any surface not insulated from the ground, while handling electric wires or apparatus, rubber boots or an insulated stool should be used.

"In moving wires, hanging on or lying over electric light wires, lamps or fixtures, use a dry hand line.

"2d. Never handle any electric wire or apparatus with both hands at once when this can be avoided, and if it is necessary to do so, be sure that no current is present, or that one or both hands are protected by rubber gloves or other efficient insulation.

"3d. When handling line wires, treat each and every wire as if it carried a dangerous current, and under no circumstances al ow yourself to make contact between two or more wires at the same time.

"4th. Never open a circuit which has been in use without giving notice to the superintendent or whoever is in charge, of your intention to do so, and at the same time request that the same line be opened at the main station, and kept open, until you have given notice that your work on that line is complete.

"5th In the dynamo room never go near the belts or dynamos, nor touch any apparatus unless you are fully informed and instructed how to do so.

"Tools used by linemen should be provided with insulating handles of hard rubber or other equally good insulator. It is the duty of each lineman to look after his own tools and see that they are in good order, especially as to their insulation.

"6th. Lamp trimmers, and others engaged in the care of lamps, must see that the switch putting the lamp in circuit is turned off before they handle the lamp in any way.

"In construction work a space of at least 20 inches must be left between the holes for pins on the cross arms, so that a lineman may get to the pole and work without danger."

The same insurance association has collected the authentic records of a number of so called electric accidents or accidents happening to the employes of electric companies. I have now before me the abstracts of 91 such cases.

The first that presents itself in looking over this set of abstracts is that very few of the accidents are in any way attributable to electricity directly, but would have occurred had the establishment in question been any kind of a factory where power was being used, or any place where heavy objects were being moved. A few examples will illustrate this, thus:

No. 1. While steadying with a pike-pole a large electric light pole which was being placed in position, a passing "low-gear," belonging to the Standard Oil Company ran over ankle.

No. 2. While assisting in hoisting a stick of timber from the street to the second floor of electric station, was injured in right foot by having the stick fall upon it.

No. 9. Was going to dynamo, stepped on iron plate temporarily covering a belt hole in floor. The plate tipped and he fell partly through the opening, injuring himself internally.

No. 17. Was oiling rocker shaft of engine near fly-wheel; leaned back too far and was struck on head by spider of fly-wheel.

The above are fair samples of the rest, and in fact out of the 91 cases but 15 (or about 16½ per cent.) have any direct relation to electricity.

As I have already mentioned, of the 15 cases in which the injury was in any way caused by electricity, there are none in which the action would not have been avoided if the above quoted rules had been observed. Thus, beginning with the first in order as arranged in the abstracts, all before it having no direct connection with electricity, we have:

No. 11. While removing the wire from a Brush dial or regulator which had become short-circuited, was slightly burned on two fingers of right hand.

In this case the beneficial effect of rule No. 2 was manifestly expressed, and had the spirit of rule 7 been complied with, even the slight injury experienced would have been avoided.

The next in order is No. 20. Was putting carbon in electric lamp which was out of order and failed to burn. Received charge of electricity which caused him to fall down from step-ladder on to radiator. Two ribs broken.

This would clearly have been avoided by an observance of rule 7.

Time will not permit me to quote all the 15 cases, and I will therefore only repeat that they would all of them have been avoided by a strict observance in form and spirit of the seven rules of direction quoted above. Of course I do not mean to imply by this that these rules are perfect or complete, but only that they seem to be in the right direction and to furnish a starting point from which further developments may proceed.

No one having an elementary knowledge of electricity as it existed 10 years ago needed or needs to be convinced of its power to do harm where all safeguards are removed, and the occasional declarations of its harmless character which have been uttered can only be accounted for by reference to that combative disposition which impels some minds always to take a view in opposition to any which may be expressed, and gives birth now and then to a book or pamphlet disproving the law of gravitation or the solar origin of light and heat. To say this is, however, far from agreeing with the other extremists who would banish electricity from our daily walks and occupations, or place it under restrictions which *might* render it harmless, but which *certainly would* render it relatively useless for the countless purposes in which its efficiency demands its full development.

The true opinion is that which is supported by past experience, and which advocates the fullest development of power to which this agency can attain, combined with the use of all the means of protection by which human intelligence can protect itself while using to the utmost this potent and therefore dangerous weapon in our victorious contest with the inimically destructive forces of nature.

[Concluded from Page 334.]

[A lecture delivered by Prof. Elihu Thomson before the American Institute of Electrical Engineers.]

Phenomena of Alternating Current Induction.

It will readily be seen from what we have shown that we have a mechanical effort exerted tending to drive away this closed conductor. We could easily use that mechanical effort to produce a movement from alternating currents. We can, in fact, use it to produce a rotary motor which turns continuously by simply being supplied with an alternating current. We can use it in the measurement of alternating currents. It has been applied to meters, to regulators, to motors, and in various ways. But it is not my purpose to go into the details of its application this evening, as we have much other matter which will take up the time. I would simply say that motors have been made which run with considerable power, and which appear to have a fair efficiency, and at the same time are self-starting—based on the principle of simply closing a circuit when it is in the proper relation to the alternating current coil, allowing it to be repelled to a distance away, then closing another circuit, and so on, making what is called the transformer type of alternating current motor. Now we have come to another department of the subject growing out of the experiments which I showed with this ring and the other ring. I have shown that if one ring be placed over the coil and another ring be brought under it there is a tendency to attraction. An attraction is exerted which brings the one ring directly over the other ring. Evidently we could use this principle also as a source of motion, because these two parallel currents may be made to attract each other, but the limit of the movement is at once found. When the rings are parallel substantially they cannot move farther—they cannot get any nearer than when they touch. But we can so modify these effects as to produce a continuous rotation, and I will show a few instances of that. I may take a copper disc mounted on pivots and this copper ring. I place the ring here over the coil and the pivoted disc alongside. Perhaps I can work it at an angle so that the effect may be better seen. (Fig. 7.) It occurs with greater vigor in this position; the

FIG 7 FIG 8. FIG 9

revolution becomes very rapid. I have only then to put this closed circuit ring over the other or inducing coil; modify the field by placing it there, and then put this rotating disc in front of the magnet there, above or below the ring—it does not matter which. If I put it above I get the effects of rotation, and if I put it below I get the same effects precisely—either one side or the other this ring may go and the disc is set in rotation. This disc is in essence nothing more than a series of rings which can be thrown into parallelism or attempted parallelism with the first ring or band, and then finding new material to one side, and which has not got into parallelism, a renewal of the action goes on and results in rotation of the disc. But I wish to call attention to one fact, that if I put the ring exactly concentric with the inducing coil I do not get such effects; I must displace it laterally. No movement occurs if I place it exactly concentric—it is difficult to find that point in this case—and if I err ever so little the disc begins to revolve. If I carry it over to the other side the disc revolves in the other direction. The effect is very easily obtained also by substituting for the ring a plate of copper (Fig. 8.) That is, the plate is virtually a ring or a set of rings, as well as the

disc, and if I place this sheet of copper in front of the pole the actions are the same as before, and if I wish to reverse the action I place it on the other side. In fact any closed circuit that I may make or bring into position in this field will so modify the field that the disc will be set in motion. It is not necessary at all that we use a copper disc. We may use an iron disc; but then we will notice something quite different. The iron disc is vigorously attracted, and we have to be careful not to let it be pulled down. You see the iron disc is now in rapid rotation in the same way, and is reversed in the same manner as with the copper disc, but there is a real difference between iron and copper in this connection, as we will see. I will put this copper disc here vertically to the ring. Now it has come to rest in a balanced position. It does not rotate, but it does rotate if I put it down in this position, parallel with the field modifying ring. Let us take the iron instead, and there is no trouble about the iron in the vertical position. Hence you see we have really a difference after all. The copper and iron do work alike, but they do not work alike altogether. Now, the fact is that we have come to deal with two different phenomena in these cases. This copper works when it is parallel with the plate or closed ring because its action depends on the circulation of currents in the plane of the disc, which cause it to rotate. The iron will work just as well one way as the other way, and at all angles, because it does not depend for its action upon currents that are set up in the iron, but simply on the property which iron has of not changing its magnetism until it is forced to. That is, it has the property sometimes called by the term magnetic friction—magnetic lag, or the more modern term "hysteresis." It is not exactly like air in its magnetic capacity. It has, in other words, a tendency to remain magnetized as it was, and so resists change when we place it in a field which forces it to change. We place it in front of a pole which does not remain north or south, but which is constantly changing from north to south, and at the rate of about 250 times a second of change. Hence, if the lower part of the iron disc gets magnetised north and the top becomes south, instantly, if this disc cannot accept the new condition of reversed poles from the core below with great readiness, it is evident that the polar part of the disc wants to leave, and the new portion, which has not been given a magnetic polarity, will tend to be brought into play instead. But when we place the disc over the inducing coil or core in this manner in a vertical plane, it simply oscillates a little and comes to rest. It does not know which way to turn. It might just as well go out one way as the other, but now this ring or closed circuit decides the question. The copper plate decides that the iron shall move in one certain direction. Now, we may analyze this action a little on the blackboard, because here we shall find a key to all these actions. We will take our magnetic pole which is changing north and south, and we will take our sheet of copper partly covering that magnetic pole. Take the disc of copper and place it above. Now, if this pole is north this lower edge of the disc will be south. If this pole is south then this lower edge of the disc will be made north. All above the lower part will become of the other polarity—if south, north up here; if north, south up here. But when we put this copper plate or ring into place it is inductively acted upon by the pole so as to produce currents in its plane. These currents are not extinguished when the inducing currents are, but are retained for a moment after the former cease and are ready to reverse. Consequently if the current has produced a certain polarity here in the lower edge of the iron disc, that current in the plate of copper will attract the magnetism, as it were, and pull it towards its own center. The polarity, if south or north, in the disc will be drawn here towards this plate or ring which tends to retain the current which was induced in it. The under side of this ring or plate will be opposite in polarity to that which induces the current, but the upper side will be of the same polarity as the pole of inducing coil just after the impulse of current in the inducing coil is ready to reverse. When we use a copper disc and lay it down horizontally, then we have two sets of parallel currents—rings slipping one over the other, and a renewal of the effect continually with every alternation.

I could amplify the disc experiments to a very great extent. Two copper discs may be taken. Now, if my explanation is right, it does not really matter which of these is moved. In other words, if currents are set up in this disc which are attracted by parallel currents in the other disc, both should move continuously in a direction to bring these currents together or toward each other. I therefore put this copper disc over the pole on that side, and this other one on this side, and you will see that both of them are set in rotation. We are really shading the pole with two discs, and they are revolving in opposite directions. The copper disc may be affected by the iron disc and both revolve. (Fig. 9.) But if I modify the experiment so as to place this copper disc over the pole in this vertical position, and this iron disc in the horizontal position, there is no effect on either disc, but if I take the iron and put it in the vertical position, and the copper horizontal, both of them will revolve after I get the right conditions. My iron disc is not very well balanced. Both discs you see are revolving, but now the iron disc is at right angles to the copper. We could, of course, by properly arranging matters, set a whole mass of discs in operation in different directions, according to the conditions which were chosen. This alternating magnetic field extends away out into the air here, and we could fill it full of discs, provided we did not cut off the field, and they would all be set in motion accordingly.

There are some other curious effects, however, produced in extending this disc experiment. Here is an ordinary steel file. If I take this copper disc and lay the steel file across the magnetic pole in this manner, and then hold the copper disc near it, we see that the steel file has the property of setting the disc in motion. If I take two discs and place them over the steel file at the opposite ends, you will find that they will revolve as though they were geared together—one out this way, and one out the other way. And as above, an iron disc placed in this vertical position over the file will revolve; or we may place it in the horizontal position and it revolves. Here the effect is the magnetic effect—not the current effect—and with the two iron discs the rotation of both of them is produced as you see, whether they lie in that plane or in any plane in respect to the file. (Fig. 10.)

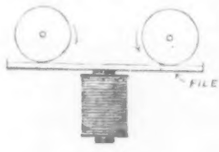

FIG. 10.

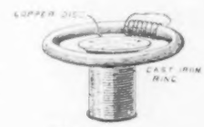

FIG. 11.

It is not even necessary to get this rotary action that we should use the file. We can take the copper disc, place it over the pole flatwise, and then simply bring another core of soft iron over the pole, but displace it a little from the axis of the other core. And you see we get vigorous rotation. In fact, this is a principle I have used in making, with some success, a small alternating motor. By simply displacing the poles and putting a copper circuit between, the rotation may be made continuous, and by multiplying the number of poles a considerable exertion may be obtained.

Cast iron behaves like steel in this connection. Here we have a curious instance of a cast iron ring on which I have simply wound a little closed coil. I place this ring over the alternating pole, say in this manner, symmetrically. I get no tendency to rotation in this iron disc. I have placed the closed coil at the opposite diameter from the inducing pole. If I make the placing unsymmetrical, however, so that the coil is on one side, then you see I get rotation in the concentric iron disc, but not very brisk. I simply put the iron disc in position, and find that the magnetism in travelling around this ring turns the disc, while this portion of the ring which is covered with a little closed coil prevents the magnetism from creeping around the ring in such direction that we do not get the opposing or balancing effect which would stop the disc. The closure of circuit of this coil simply prevents the propagation, as it were, of the waves of magnetism from the alternating pole in this direction at the same rate that they go in the other direction around the cast iron ring. Consequently we have a rotation of the disc in this direction, and showing us in a different way what we are getting with the file. (Fig. 11.) We were getting waves of magnetism which passed out along the file in each direction, and which took some time to so pass, that is, beginning in the middle of the file at the pole, and moving out and only reaching the end after a little interval; the reason being that the file, although it is not surrounded by closed circuits, as is the case with the cast iron ring, has another property which I mentioned before—magnetic friction—which opposes quick changes of the magnetism. It uses up force to effect such a change. It warms, not by induced current, but by the effort of the field to turn the molecules first one way and then the other in producing opposite polarities. The actual result of that action is as follows: We will consider the instance of the file. That we will suppose is laid across the pole. When the pole is south, the file would be north at its center. When the pole changes to north the north in the file splits, as it were, and moves outward, while the center becomes south, and the two norths travel out along the file oppositely, and being north poles they, of course, are surrounded by magnetic lines, and in fact are moving consequent poles for the time being.

Now we may put here a disc of copper or iron, and these magnetic poles or lines are sweeping along the file. They act like magnetic brushes that are brushing the disc around, and they disappear in closing

themselves up or neutralizing, as it were, at the ends. That is, when a pole in travelling goes so close to the end of the file it is so near an opposite pole as to neutralize it, at which moment the action ceases so far as those lines are concerned, and a new set are sent out to travel along, and this goes on continuously at every wave of alternating current.

We have an example here of a little alternating motor of a very small type, which is built up on the principles we have been showing, only we have a different form of magnet. In this case I have a circular core. That is, I have a ring of iron which would return on itself; but I have cut a slot through it of about ¼ in. in width. On the sides of the slot I have placed copper circuits which are closed—closed bands in which currents can be produced. But I have offset them so that there are more on one side than on the other—so that the poles are shaded on one side and not on the other. If I introduce a copper disc into the slot here and put on the current, we will see that we have an alternating motor produced (see Fig. 12), and it exerts some power. This machine, however, I use for another purpose. I have two coins, and one of them I lay on my hand in this fashion just below the slot, and it is drawn in and thrown violently out, up through the slot. (Fig. 13.) In other words, the silver coin tends to do what this disc did—continually move up through the slot. But this disc may be regarded as a lot of coins stuck together, and consequently we have continuous movement. Here we have only one disc. But we will try the other coin. With that we get no such effect. It is a counterfeit. But listen (ringing the coins), there is not very much difference in the ring. One might easily be deceived. But the machine knows the difference. The silver of the genuine coin is a good conductor. Silver, even with an alloy of a baser metal, like copper, retains a large portion of its original conductivity. Consequently the currents induced in the silver are much more considerable than can be induced in this base coin, which is not so good a conductor. Anything that imitates silver does not come anywhere near it

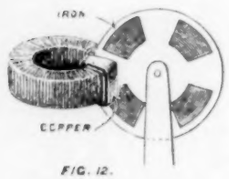

FIG. 12.

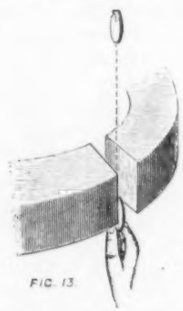
FIG. 13.

in conductivity, especially if it is expected to weigh as much as silver, in which case lead is generally one of the constituents; and this alloyed with other metals is still worse. I keep these coins in separate pockets, as you see.

Now, there are some other curious effects of rotation which are rather modifications of what has already been shown, but they are certainly curious. They are explained on the same grounds which explain the rotation of the disc, and to which I have referred; but from their uniqueness they are perhaps more interesting in some ways. They are certainly in a popular sense more interesting, because the actions are somewhat unexpected. Here is a hollow copper ball. I place a brass plate over the alternating pole, and it projects not two-thirds over. I place the copper ball on the plate, and you see the copper ball at once spins. Placing it on the other side it spins in the other direction. It is behaving just like a copper disc placed over another disc. Here is a little one, a smaller ball, the spinning top of the future.

You have heard the old rhyme about the dish running away with the spoon. I am going to have it modified in this way: I have a brass dish here which will run away with the cup. We have the same spinning-top effect. It is not at all necessary that we use a plate for that purpose. I showed you some time since the equivalency of a plate with a ring, and I shall now merely make a momentary substitution of this copper ring with a mica sheet, to rest the bodies on, and you will find that the copper ball spins in that ring as though placed on the plate. But a more surprising effect is yet to come. I shall have to put on a guard rail to the apparatus in this case to prevent the ball running away from us. I have two glass pins in a plate which partly shades the pole, and I lay the copper ball against those pins. The ball rotates over this way and actually overcomes the friction of its lower side on the plate. It has to turn on a horizontal axis and its equator rubs the shielding plate. The action is very vigorous, as you see. (Fig. 14.)

One of the nteresting modifications of this experiment we will attempt to show. It is somewhat analogous to the experiment of the lamp immersed in water. I put over the core a vase of water. We have the alternating current on. But you see there is no action of the ball. It requires that we place underneath a shading disc. Now, we have a rotation of the ball in the water. This may become quite vigorous, and we obtain extra vigor by putting a copper ring in the water. This is a pretty modification of the other experiments, and has this advantage, that the ball keeps cool. In the other case the ball gets warm. The currents are so energetic that they actually warm the ball. Now the ball is rotating right in the copper dish, and sometimes when we get sufficiently vigorous action the dish and the ball both are set into vigorous rotation. Now the dish is going about or turning. We might fill the water with small balls. I have had three of them in operation at one time rotating in different ways. (Fig. 15.)

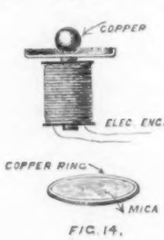

FIG. 14.

FIG. 15.

One or two more experiments in this direction. I here have mounted a somewhat different arrangement. I have a little wheel or rim of copper with an iron interior. That is, it is like the armature of a dynamo wound with wire or covered with a conducting envelope. We place a wedge of iron on the pole and then I shall bring this on the one side or the other of the edge of the wedge. You probably cannot see the action, but you will perhaps take my word for it, that the little wheel is revolving very rapidly, and if I put it on the other side it revolves in the other direction as though a jet of something were shooting off that edge. This jet is nothing more than the travelling system of magnetic lines. You are all familiar with the gyroscope—the instrument which you had generally to spin by winding a cord and pulling it off the shaft. Here is a gyroscope which is the gyroscope of the future. You do not require a string or battery, except the alternating current field. You do not require any connection with the instrument. I put a center for it to move on in the magnetic pole. Already the little disc is rapidly revolving and I will let go of it in the ordinary way of the gyroscope, and you will see it turns about. It will get up to quite a speed in a little while, and then you will see that the gyroscopic action is very beautifully manifested. Now the thing that causes rotation in this case is the little inclined frame holding the wheel. It does not lie, as in an ordinary gyroscope, horizontally, but it lies in an inclined position. The wheel is simply a copper wheel with a laminated iron core supporting the copper ring. It is getting up a very high speed now, and the gyratory rotation is consequently slow—one of the phenomena of the gyroscope (Figs. 16 and 17.) To reverse the rotation I would do as with any gyro-

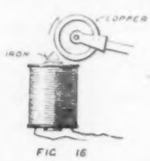

FIG. 16

FIG. 17

scope—simply move the weight so as to bring the balance outward instead of inward, and then the rotation would be opposite in direction. Now the rotation is in the opposite way. I have overset the gyroscope by putting the weight out from the pivot so as to overbalance it.

Dr. Geyer—Have you ever taken the weight off altogether?

Professor Thomson—I haven't tried that, but it is possible, I think, with very high speeds. But if I take the weight off the copper frame it does not retain its angular position. I need the weight to hold it in place. I must have the angle of the frame preserved. The deflective action comes into play to turn this circuit to right angles. With this experimental illustration we see that a curious series of phenomena are manifested by alternating magnetic fields.

There is but one other statement I wish to make before closing, and that is as to the marvelous capacity for the transfer of energy which an induction coil possesses. If we could imagine an induction coil, that is, a coil composed of a winding, which acts to produce currents in another winding, carried to a very low temperature, we could have the resistance of the copper to the passage of the current almost obliterated. Then

we would find that we could load the copper coils with an enormous amount of current. They could probably be made of tubes and refrigerating fluids passed through them. We would find the actual amount of energy which could be conveyed from one circuit to another by a moderate-sized coil and with a core of very moderate dimensions—that is, with an iron core and a magnetic circuit of very moderate dimensions, would be counted by thousands of horse power. Our experience has taught us that even under ordinary conditions it is no unusual thing to transfer 30 or 40-horse power through a magnetic core which a man can easily lift, and do it efficiently and well. The iron part of the apparatus has very little to do with the action. We could take it out altogether if we could refrigerate our coils and wind the two coils close together. The induction coil is probably one of the most striking examples or proofs, we may say, of the fact that the actual mode of transference of energy along an electric wire is not through the copper of the wire; it is through the medium outside of the wire. The modern view of electricians, gradually becoming more and more credited, is that the wire is merely the core of a set of disturbances which are really propagated around it. That is (illustrating), if we have a wire conductor carrying a varying current, that current is merely an incident of something which is going on all around in the space surrounding the wire, in the ether—in the medium which surrounds all bodies, and which fills all space. Now, it is manifest, if this be true, if the varying current is merely an incident of this propagation of energy in that medium—put another wire there and you ought to have a current as an incident of the propagation, and if you coil those wires up together so as to make a coil in which two conductors lie side by side, as in an induction coil, if the propagation of energy is thousands of horse power, and this current in the center an incident of that propagation, thousands of horse power may be represented by the currents, of which this is an incident, too; or, in other words, the two circuits are in the same relation exactly to that thing which represents or carries energy. The primary circuit and the secondary circuit are really immersed in the thing which is conveying electrical energy, the wire merely serving as a center around which the energy shall be propagated. I thank you for your attention this evening, and if I have not been very scientific, I hope I have shown some things which have been of some little interest.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE proprietors of the Pennsylvania (natural) Gas Company have sent out notices to the effect that on and after October 1st residents of Jamestown, N. Y., and vicinity, will receive their supply of gas for fuel *only* through meters. This order has been received by the people with a fine show of indignation, but all their storming will have no effect, since it is not to be supposed that the Philadelphia Company can be prevailed on to keep up a losing business.

THE Mayor of Parkersburgh, West Virginia, who was instructed by the Council to investigate and report upon the feasibility or good policy of engaging the city in the operation of a municipal electric lighting plant, is said to be opposed to the project. It is our opinion that the further he goes into the subject the stronger will become his disinclination to sanction the scheme.

WE understand that the proprietors of the San Antonio (Texas) Gas Company have met with such success in the development of their electric lighting annex that an increase in the capacity of the same—amounting to about 50 per cent.—has been determined on. If this is so the Company will be able to supply 2,250 incandescent (16-candle power) lamps. The Westinghouse apparatus is in use at San Antonio.

Under the agreement between the authorities of Newark, N. J., and the gas companies of that city, the latter will put down something like 4 miles of gas mains this fall. The mains, according to the ward districts of the city, will be thus apportioned: Sixth Ward, 1,500 feet; Eighth Ward, 5,000 feet; Tenth Ward, 1,000 feet; Eleventh Ward, 3,500 feet; Twelfth Ward, 2,800 feet; Thirteenth Ward, 3,000 feet; Fourteenth Ward, 2,800 feet.

AT a meeting of the Fire and Gas Committee, Toronto (Canada) City Councils the opening of tenders for the public lighting was the feature. The Toronto Electric Light Company, on the basis of a supply of 800 arc lamps, made the following propositions: For 1 year contract, 38 cents per lamp per night; 2 year contract, 33½ cents; 5-year contract, 29¾ cents. This is on the basis of 2,000 candle power and 3,932 hours of lighting. A second electric tender, proposing the employment of the Westinghouse system, was rejected, because the necessary certified check did not accompany the proposal. The Consumers Gas Company submitted the following propositions—the first series being based on the idea of the Company's performing the entire lighting of the city:

For two years.—Lamps fitted with burners consuming 4 cubic feet per hour, and a total service of 4,297 hours, $19.50 per lamp per annum; for total service of 3,932 hours, $18.35 per annum; ordinary gas lamps, consuming 5 cubic feet per hour, $22 each per annum; Lambeth high-candle power lamps, consuming 25 cubic feet per hour, $77.50 each per annum.

For three years.—Ordinary lamps, 4 cubic feet per hour, $19 per annum; lamps using 5 cubic feet, $21.50; Lambeth pattern, $75.75.

For five years.—Ordinary lamps, $18; 5 cubic feet, $20.50; Lambeth pattern, $72.50.

On a basis of the maintenance of 2,000 lamps, the Company's propositions were:

Two years.—Ordinary lamps, 4 cubic feet, $22 per annum; ordinary, 5 cubic feet, $24.50; Lambeth pattern, $80.

Three years.—Ordinary lamps, 4 cubic feet, $21.50; 5 cubic feet, $24; Lambeth pattern, $78.25.

Five years.—Ordinary lamps, 4 cubic feet, $20.50; 5 cubic feet, $23; Lambeth pattern, $75.

When the tenders had been read it was resolved to refer the bids for report to a committee consisting of Alds. Bell, Maughan, Shaw, Macdonald, McDougall and Frankland.

THE plant and franchises of the Georgetown (Ky.) Gas Company have been purchased by the Georgetown Water Company, the proprietors of the latter also being the owners of the local system of electric lighting supply. The capital stock of the Gas Company was $22,000, and the combined capital of the consolidated enterprise is $100,000.

"DEAR JOURNAL: On Wednesday, of this week, the annual election of the Worcester (Mass.) Gas Light Company will be held, when, in addition to the usual routine business transacted on such occasions, the shareholders will be called on to vote on a proposition for engaging the Company in the business of supplying electric currents for light, heat and power purposes. Also, to authorize the issue and sale of 2,000 shares of new stock, to enable the Company to go on with the proposed new venture. I say proposed, but in reality it can be taken for granted that the determination to so engage has been virtually reached, else why should the call be made to include means for raising money, etc. The whole truth of the matter is that the Worcester Gas Light Company and the Worcester Electric Light Company have agreed to consolidate their fortunes, in proof whereof I forward you the inclosed clippings.—OBSERVER." The clippings (from the Worcester *Spy*), dated September 4th and 5th, respectively, are appended:

"A consolidation of the Worcester Gas and Electric Light Companies is probable. At the annual meeting of the Gas Company, September 17th, the 170 or more stockholders will be asked to authorize the Directors to engage in furnishing electricity for light or power, and to increase the capital stock from $500,000 to $700,000. President Lamson, of the Gas Company, says that the Directors have reason to believe that if the stockholders granted the authority asked for, a satisfactory bargain could be made with the Electric Light Company for the purchase of its plant. 'This is the way the Directors look at it,' continued Mr. Lamson. 'The Gas Company is in a prosperous condition. Its business has increased 30 per cent. in 2 years, and its stock pays 8 per cent. Meanwhile, I think, the public will generally admit that we have furnished gas of good quality and full supply, and have lighted the city well. Worcester is growing, the gas business is good, and so is the electric light business. Combine both under one management and each will gain by economy of management and by the experience of those who have had charge of the separate branches. Each can work to better advantage in combination than in competition, and the public will be better served. Owing to the great increase in our business we have been compelled to enlarge our works. We have been engaged in this for more than a year and the new apparatus will not be finished till next year. We are building a new retort house of great capacity, and are putting in a large set of exhausters and condensers, and a large station meter. Our residual products, especially coke, accumulate with great rapidity, and we think we see in the electric light business a way of disposing of some of them. Like all the larger companies in the State, we can see that it is to our advantage to go into electricity, and we hope to do it.' Being asked if a consolidation with the other company could not be effected, whether the Directors would establish an electric plant of their own, Mr. Lamson replied: 'That question goes further into the matter than I am at present disposed to discuss. The Directors need only the authority of the stockholders to supply electric light. As to

the details of the manufacture, we have power to do as we see fit. Whether we make electricity or gas, we intend to have one of the best plants in the country. Two years ago the Electric Light Company made advances to us looking toward consolidation, but for various reasons we could not then see our way clear to consider the matter, and it has since been in abeyance till a short time ago. The occasion now seems ripe for the union.' President T. M. Rogers, of the Electric Light Company, when appealed to on the subject, said he believed it was for the interest of his own Company and that of the Gas Company to unite—the capital of the former is $200,000, just the amount which it is proposed to add to the capital of the Gas Company. 'We have,' said Mr. Rogers, 'an uncommonly good plant, and I hope to see the entire city lighted by gas and electricity and the unsatisfactory gasoline lamps abolished. The lighting business is our business, and an improved service will benefit the city. We began seven years ago with 75 lights. Now we have 500 lights, and our capacity is very much larger than that. A dynamo to furnish a suburban circuit of incandescent lights of small candle power could be very easily accommodated for the purpose of supplanting the gasoline lamps. As to our earnings, I want to say this. Our capital has been increased from $100,000 to $150,000, and to $200,000, and we put in no water. It is all good, honest money. Our dividends have averaged 4½ per cent yearly. All earnings above this have been put in the plant. The electric light business has been good, but I am not willing to trust to memory and say how much has been earned above the dividends and put into the plant. Our regular statement has been submitted to the Gas Commissioners and will soon be made public. The advantages of consolidation are many, from our point of view, but the most obvious is the utilization of the Gas Company's coke, which we shall be able to burn in our peculiar furnaces. That will be an advantage to both.'"

THE new up-town office (it is at No. 434 Maine Street) of the Quincy (Ills.) Gas Light Company is one of the handsomest places devoted to business in that city. However, it could not very well be otherwise when the affair was under the supervision of such a man as "Gus" Littleton. Whatever he does is always well done.

CLOSE observers say that there will be a scarcity of natural gas this winter at Toledo, Ohio.

MISS MARY C. HOFF, daughter of Superintendent Hoff, of the Princeton (N. J.) Gas Light Company, is now Mrs. James McCormick, of this city. The marriage was celebrated in St. Paul's Church, Princeton, something over a fortnight ago.

MR. RALPH WOODWARD, formerly at the Waltham (Mass.) works, has accepted a responsible position in the works department of the Hartford (Conn.) City Gas Company. Mr. Harbison has thus secured the services of a competent man.

WE understand that the Joliet (Ills.) Electric Light Company and the Thomson-Houston Company, of the same city, have disposed of their plants, etc., to a Company called the Economy Light and Power Company, which is backed by a syndicate, the principals therein being J. L. Norton, of Chicago, and J. E. Ingalls, of Joliet. The new Company is capitalized in $400,000, and it is to be managed by L. E. Ingalls, of the Westinghouse Electric Company.

THE proprietors of the Doylestown (Pa.) Gas Company may put in an electric plant of the Edison type.

THE Electric Light Company, of Laconia, N. H., has increased the rate for each 16-candle power incandescent lamp supplied, from 60 cents to 75 cents per month, lights to be extinguished at midnight.

MR. W. C. ADAMS was interviewed recently as to the capacity of the present city gas works, of Richmond, Va., and as to the likelihood of the plant being able to answer satisfactorily the demands that will be made upon it this winter. In replying to his questioner, Supt. Adams said: "A very large amount of work has been done at the generating department of the works this year. Four of the old purifiers that were put in in 1872, when the maximum consumption of gas was about 400,000 cubic feet per day, have been enlarged as far as possible to accommodate the increased make of gas, the demand for which grows with each year. A new station meter, rated to pass 1,000,000 cubic feet per day, has been completed and is working satisfactorily. Ten benches of retorts have been rebuilt and put in thorough order for the winter make. In fact every portion of the lower works is in good condition and fully equal to meeting the demands of a heavy fall and winter consumption. The large holder at the upper works is badly in need of repairs, but owing to the increase of consumption and the lateness of the season, and through not having any extra appropriation for the work, I will try and run through the winter with the slight repairs that my regular force can make. The holder capacity of the works is very limited, and I have in several of my annual reports called the attention of the Committee on Light, and the Council, as well, to this fact. Had the authorities empowered me, as I requested on more than one occasion, to install an auxiliary water gas plant, I could, with one or two minor improvements, supply the city for some years from our present holders, with a gas of a higher candle power than that now distributed. The outlook for the coming winter for a large increase in the consumption of gas was never better."

SUPERINTENDENT KEPPEL, of the Tiffin (O.) gas works, was seriously injured the other day because of the antics of a vicious horse.

THE two inspectors, who were appointed last spring by the authorities of St. Louis for the purpose of reporting any failures that might occur in keeping the public arc lights burning in accordance with the lighting schedule, were discharged last week. Reason: no money in the treasury applicable to the payment of their salaries. This work will now devolve on the police.

HAVING heard that there was much dissatisfaction in Yonkers, N.Y., over the expensiveness and inefficiency of the system of arc lighting in vogue there, we addressed an inquiry to a reliable party respecting the charges made, and the following answer was returned thereto: "Electric arcs were first introduced in the public street lighting of Yonkers in 1886, on the offer of the Electric Company to make the cost of the same 10 per cent. less than the gas lamps then in use. The offer put in this shape made it necessary to know how many gas lamps the arc lamps could replace. The gas lamps then cost $13.92 each per lamp per year. Ten per cent. off this amount makes $12.53 per lamp per year, or about $1 and 44 mills per month. The monthly bills of the Electric Company for the past 2 or 3 years have been $224.49, which divided by the $1.044, gives 215 gas lamps at one time displaced by the electric lights. But on further inquiry I find that the electric lights left so many dark corners that great complaint was made, and the Common Council found itself compelled to order some of the gas lamps relighted in order to help out the electric lights, and that at least 13 gas lamps have thus been ordered relighted in the electric district, and are now burning every night to make up for some of the deficiencies of the electric lights. This leaves 202 gas lights now replaced by the arc lights. Now I learn that the Electric Company is sending in its bills for 52 arc lights, which is in addition to a number of arcs (I do not know how many) that are furnished without charge. However, without counting the arc lights not charged for, the city is now to pay for 52 arc lights to replace 202 gas lamps. These 52 arc lights, at $99.50 per year each, the new price, cost $5,174 per year, while 202 gas lamps, at the new price of $20 per year, including *all* cost of maintenance, would cost $4,040, showing an excess of cost of electricity over gas of $1,134 per year in that small district, or $5,670 in the 5 years of the term. Electricity is thus costing 28 per cent. more than gas. The present electric light district is chiefly the business part of the city, with few trees or obstructions, and can be lighted by electricity with less cost than any of the residence districts. Is not the fact that this district costs 28 per cent. more to light than gas a good reason against enlarging the electric light district? The extensions proposed (it is this proposed extension that has evoked the outcry) must end in new lights, as was done in the old districts, until the electric lights will cost 30 to 50 per cent. more than gas, and will burden the city with $20,000 or $30,000 cost in excess of gas during the proposed 5 years of the contract. This is saying nothing about the greater reliability of gas lamps, nor of the advantage of the more uniform distribution of light by gas, nor of the saving in unsightly poles and wires, and in the destruction of trees. Yet these considerations, it seems to me, ought to demand gas lamps in all residence districts, in place of electricity, even at the same cost, and still more when the inconvenience and unreliability of electricity, with the disfigurement of streets by poles and wires, will cost 20 or 30 or 40 per cent. more than the same work can be better done by gas lamps."

In addition to our prior report (last week's issue) of the annual meeting of the Providence (R. I.) Gas Company, we have been forwarded the following, culled from the report submitted to the stockholders: About 25 stockholders were in attendance. The official statements showed continued growth, enlargement of the works, sustained receipts and undiminished dividends, though in the face of reduced prices for gas—a reduction of 10 cents per 1,000 was made on July 1st, bringing the net price to $1.30. The amount of gas produced in the twelvemonth was 475,525,000 cubic feet, of which about 24,000,000 cubic feet was water gas. This is an increase of 36,571 000 cubic feet over the product of last year, and an increase of 110,500,000 for the last three years. The receipts for residual products—coke, tar, etc.—amounted to $60,000, a gain of 12½ per cent. The weight of coal carbonized was equal to 40,257 tons, and the quantity of oil used for carbureting the water gas was equal to 111,805 gallons. The water gas plant at the South Station was put in operation on January 30, and the corresponding plant at the West Station will be ready in ample time for the coming winter season. This strikes us as a record that speaks volumes for Mr. Slater's careful and progressive engineering.

THE proprietor of the Nutt House, Crawfordsville, Ind., got into a dispute with the local Gas and Electric Light Company over the accuracy of the bills presented by the latter for the illumination of his premises. He had his choice of settling the account—the Company had gone over the meters, etc., very carefully—or of trying kerosene, whereupon he paid the bills. He then instituted suit against the Company for damages in the sum of $2,000, and the trial of the case ought to result in very interesting proceedings.

THE capital stock of the Lewiston (Idaho) Water and Light Company has been increased to $100,000. Construction work will, however, not be proceeded with until next spring.

MCGUIRE'S Fuel Water Gas Company, at St. Joseph, Mo., is in trouble. The authorities do not like the way in which the streets are "restored" by the Company's mainlaying contractor.

ON Nov. 1 the Boston Gas Light Company will begin to distribute a non-enriched water gas for fuel purposes. A separate set of mains, laid through a section of the city which holds a large number of manufacturing establishments, will be used, and the North End Station of the Company will be the source of supply.

SUPT. HODGSON, of the Westerly (R. I.) Gas and Electric Light Company, is in high feather over the increase in that Company's business. The gas and electric plants are in good order, and Mr. Hodgson proposes to keep them fully up to standard.

GAS is to take the place of electric lights in the illumination of the Brockton (Mass.) depot of the Old Colony Railroad. An equally satisfactory result, at a much lower cost, accounts for the change.

THE Wright Engineering Company will make the proposed additions to the electric lighting plant of the Clinton (Mass.) Gas Light Company. When the scheme shall have been completed, the Company's electric annex can be depended on to maintain 130 arcs and 1,800 incandescents.

These improvements were planned because of a desire on the part of the town authorities to increase the measure of public lighting by electricity. At least it would seem reasonable to so infer from the fact that the Selectmen have entered into a contract with the Company on the following basis—the agreement to run for 5 years: Arc lights of 1,200 candle power, to burn until midnight, to be paid for at the rate of 25 cents per arc per night, and incandescents, of 25 candle power, to burn until daylight, to cost 5¾ cents per light per night.

COL. CHARLES F. WOODWARD has been elected President of the consolidated gas and electric lighting interests of Wakefield, Mass.

A WILLIMANTIC (Conn.) correspondent, writing under date of Sept. 8, says: "The Citizens Gas Light Company, of this place, has been organized with a capital of $50,000. Its officers are: President, E. S. Boss; Treasurer, O. H. K. Risley; Secretary, Julius Pinney. The formation of this Company will, we hope, result in the furnishing of a good quality of illuminating gas—something Willimantic has never yet had. On. Sept. 4 the Court of Burgesses gave the new Company permission to lay pipes through the streets of the borough, and construction work will soon be underway.—HADDAM."

ACCORDING to the reports of the Philadelphia Bureau of Gas for the month of August, the receipts amounted to $180,462.52, an increase of $440 over the same month in 1889; expenditures, $195,481.02, a decrease of $21,000 from August of last year. The increase in quantity of gas manufactured is returned at 3,200,000 cubic feet.

THE *Inter-Ocean* says that an assumpsit suit for $10,000 damages has been entered in the United States Circuit Court by the Standard Oil Company against the Chicago Gas Light and Coke Company. The suit is over a bill for oil and naphtha, there being a difference between the parties in interest over a construction of the contract under which the materials were delivered.

THE authorities of Independence, Mo., are about to ask for proposals from contractors for the public lighting of the city.

MR. EBEN STORER, who for 30-odd years was in the service of the Brooklyn Gas Light Company, has resigned.

THE following correspondence explains itself:

BOWLING GREEN, KY., Sept. 8th, 1890.

To the Editor AMERICAN GAS LIGHT JOURNAL:

I believe the gas fraternity now look upon your JOURNAL as authority on matters pertaining to gas interests, and as a gas man deeply interested in the future of illuminating gas for heating purposes, I beg your consideration regarding the effect of burning atmospheric gas (illuminating gas reduced with air) in a room when water is placed so as to vaporize and mix with the burning gas or products of combustion, such products of combustion being left in the room. A certain manufacturer of gas heaters does this, and claims wonderful results. This heater consists of a hollow cast iron log, made in imitation of a hickory log wood fire. The log contains about 2 pints of water, which is generated into steam by the burning gas, the steam rising into a radiator above. Beneath this burner is an evaporating pan, from which a quart of water is vaporized daily. It is claimed that this vapor not only neutralizes all gases and odors which permeate the air, but also serves to render the air soft, balmy and wholesome. It is further claimed that no chimney or flue is required when this heater is used. Now it so happens that I am pleased with this heater and want it to succeed, but being a "doubting Thomas," and a poor chemist, I have expressed my doubts to the manufacturer. I enclose a copy of his reply (omitting names), which strikes me as being novel and may prove interesting to your readers. If all the heat from burning gas can be retained in a room without producing odors, or destroying the purity of the air, much has been accomplished in the direction of economy in gas heating. I, therefore, send you this with a view of developing the facts, so that we gas men may not deceive our customers and thus retard the advance of gas for heating purposes; or, if this invention has merit, we can join hands and make the owners rich. Very truly yours, GAS MANUFACTURER.

The reply referred to by our correspondent is appended:

"Your letter of August 29th is at hand, and contents noted. We of course still claim that you are quite at variance with the facts in stating that gas cannot be burned satisfactorily without having a flue connection; and right here lies the great point in the ——— Heater. We will endeavor to explain again what we do with the products of combustion and how we treat the air. Please consider for a moment the action of the sun upon the outdoor air. Its heat draws from the surface of the earth a vapor which passes through the air, neutralizing and attracting to itself whatever there may be of impurities and foreign matter in the air. By this simple and natural process the carbon, carbonic oxide and carbonic gases, which are being continually thrown into the air from animal life and so on, are successfully and perfectly neutralized and removed, so that the air returns exactly as it was, with the exception of the impurities being replaced by pure oxygen. Now, this same process is employed in treating the air of a room in which a ——— Heater is in use. The intense heat of the flame acts as the heat rays of the sun, and the evaporating pan below the burner supplies the vapor. In this manner you will discover that the air of the room is being continually purified, inasmuch as it is all brought in contact with the flame and the vapor, within a reasonably short space of time, through the agency of a continual circulation. Add to this the fact that by actual chemical analysis, the ——— Burner burns the gas and the products of combustion so perfectly that we have but two results, which are—heat, primarily, and, to a limited extent, carbonic acid gas. If this explanation is in your judgment based on false laws, then the only way to satisfy yourself is to procure a heater and experiment with it."

A WORKS for the creosoting of timber has been established at Oakland, Cal.

NOTES.—Mr. William E. Fullagar, nephew of the late John Fullagar, has leased the works of the Port Jervis (N. Y.) Gas Light Company, the agreement to run for 5 years, from the 1st inst. Mr. Fullagar was formerly lessee of the Georgetown (Ky.) Company.——Messrs. R. L. & J. H. Holt, Jr., of Burlington, N. C., ask for estimates for lighting their cotton mill, either by gas or electricity.——The Laclede Gas Company (St. Louis) has removed its meters from the Poor House, Insane Asylum and Female Hospital. These buildings are now lighted by electricity, and the amounts received for gas by the Company were insufficient to reimburse it for even keeping the mains in repair.

The Market for Gas Securities.

High rates for money last week caused many alarmists to predict a panic, or near approach thereto; but so far these predictions have not been borne out. The drawing in of the purse strings, however, played havoc with speculators whose ventures were scantily margined, and a general slump all round in quotations was the result. Consolidated fell off to 96 bid (noon, Friday), but not many transfers were recorded. Chicago gas, on Thursday, broke to 44½, and has not yet manifested an inclination to substantial reaction. Rumor has it that the Company and the city will soon settle their differences, the idea being that the Company will agree to sell gas at $1, net, per 1,000. The shares are decidedly a bargain at anything under 50. The general situation remains unchanged. We note sales at auction this week of Standard preferred, as follows: 5, at 87½, and 130, at 85.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

September 15.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	96	—
Central	500,000	50	90	100
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	125	130
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	115	—
Mutual	3,500,000	100	120	122
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co —				
Common Stock	5,000,000	100	40	45
Preferred	5,000,000	100	85	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	120	123
Citizens	1,200,000	20	92½	93¼
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	140	145
" Bonds	300,000		104	105
Peoples	1,000,000	10	98	100
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	109	111
Nassau	1,000,000	25	130	—
" Ctfs	700,000	1000	100	102
Williamsburgh	1,000,000	50	131	—
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co. —				
1st Series S.F. Trust	7,000,000	1000	93	93½
2d " " "	3,000,000	1000	71	72
Bay State Gas Co.—				
Stock	5,000,000	50	78	80
Income Bonds	2,000,000	1000	95½	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Company.	25,000,000	100	45	45¼
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	100	—	92½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	98
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	94	98½
Consumers Gas Light Co., Jersey City	2,000,000	100	20	—
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	6,000,000	100	201	203
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			80	90
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	50½	50¾
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
Hartford, Conn	750,000	25	102	108
Jersey City	750,000	20	170	175
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	17	17½
Preferred "	2,500,000	100	—	55
Bonds	9,034,400	1000	80	81
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds.	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal.			35	36
Peoples, Jersey City		—	60	61
" " Bonds.			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	99	100
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co.				
San Francisco, Cal.	10,000,000	100	59	59½
Washington, D. C.	2,000,000	20	200	208
Wilmington, Del.		50	88	90

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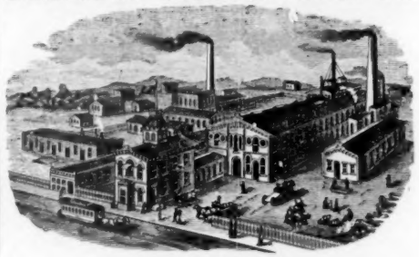

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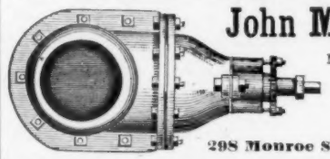

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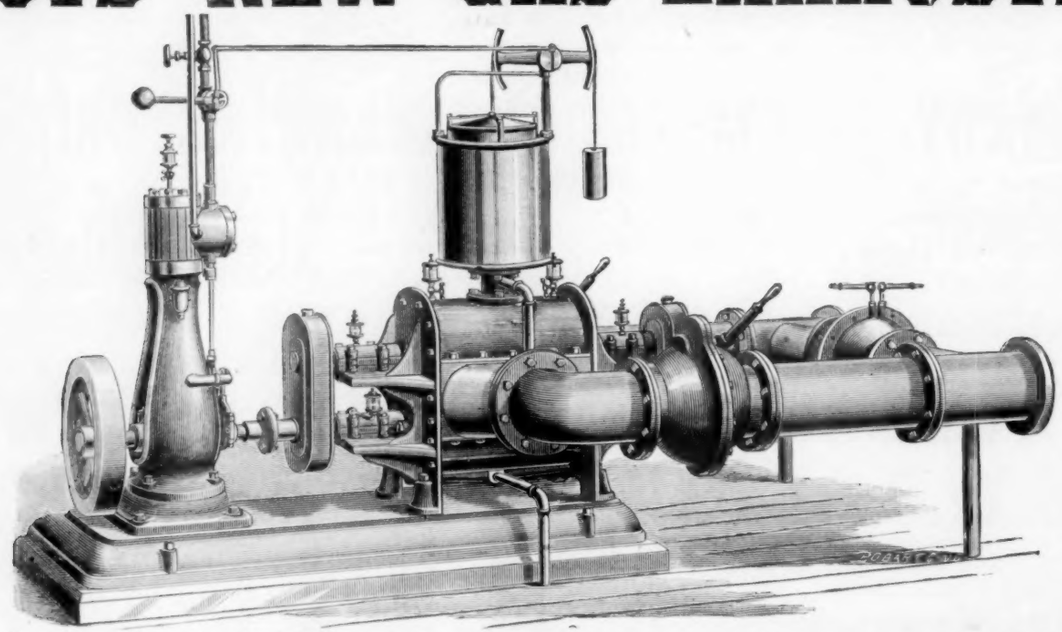

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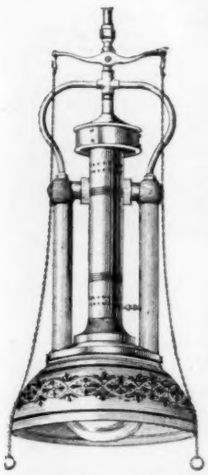

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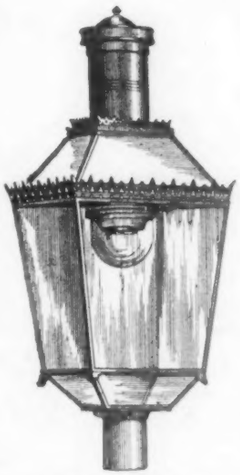

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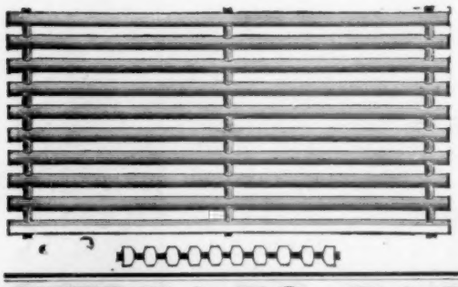

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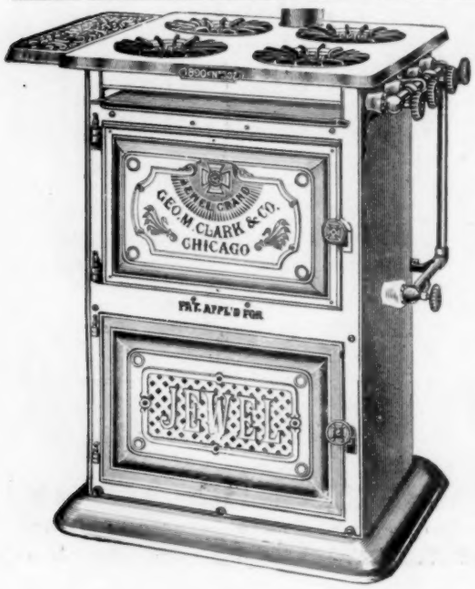

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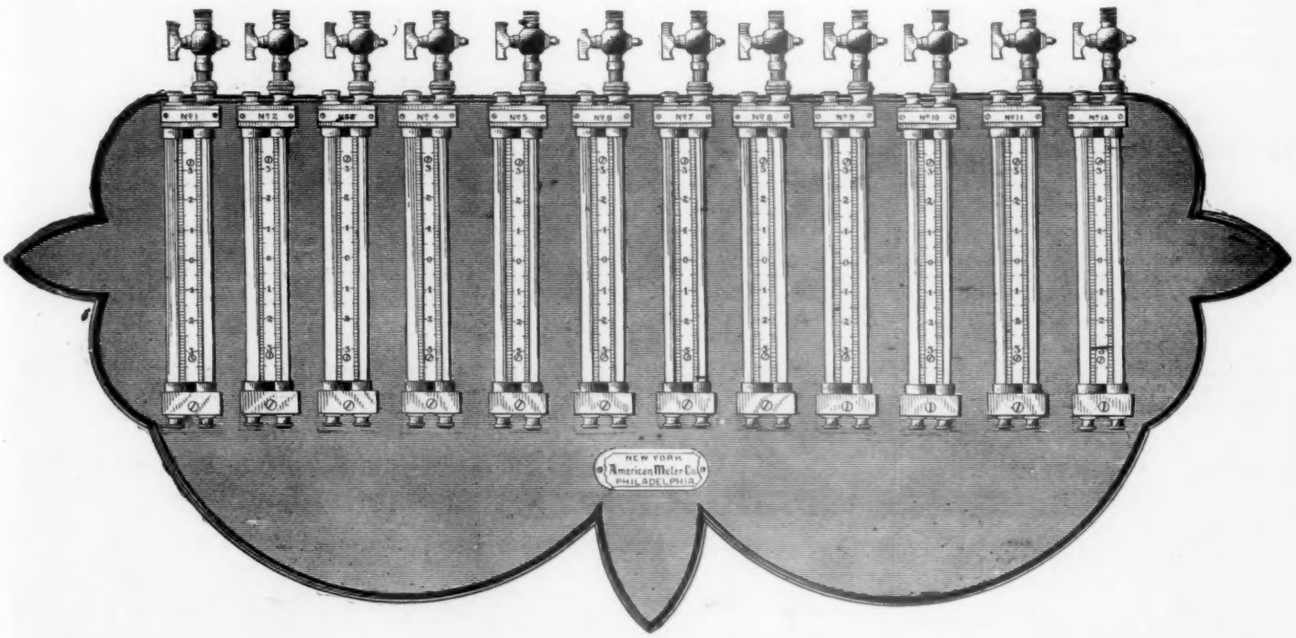

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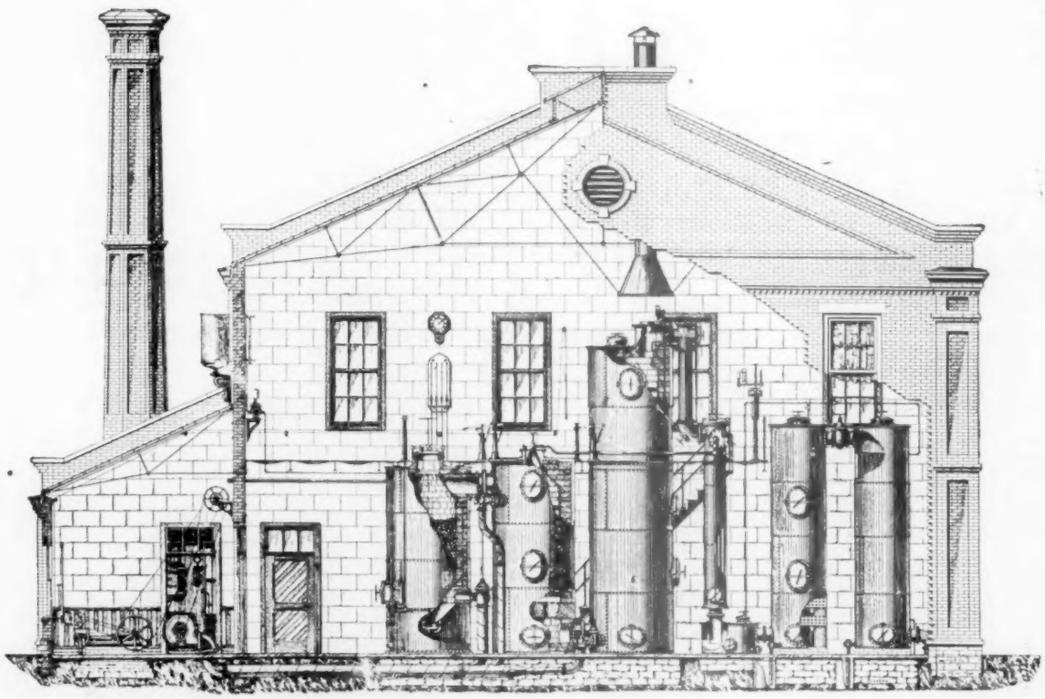

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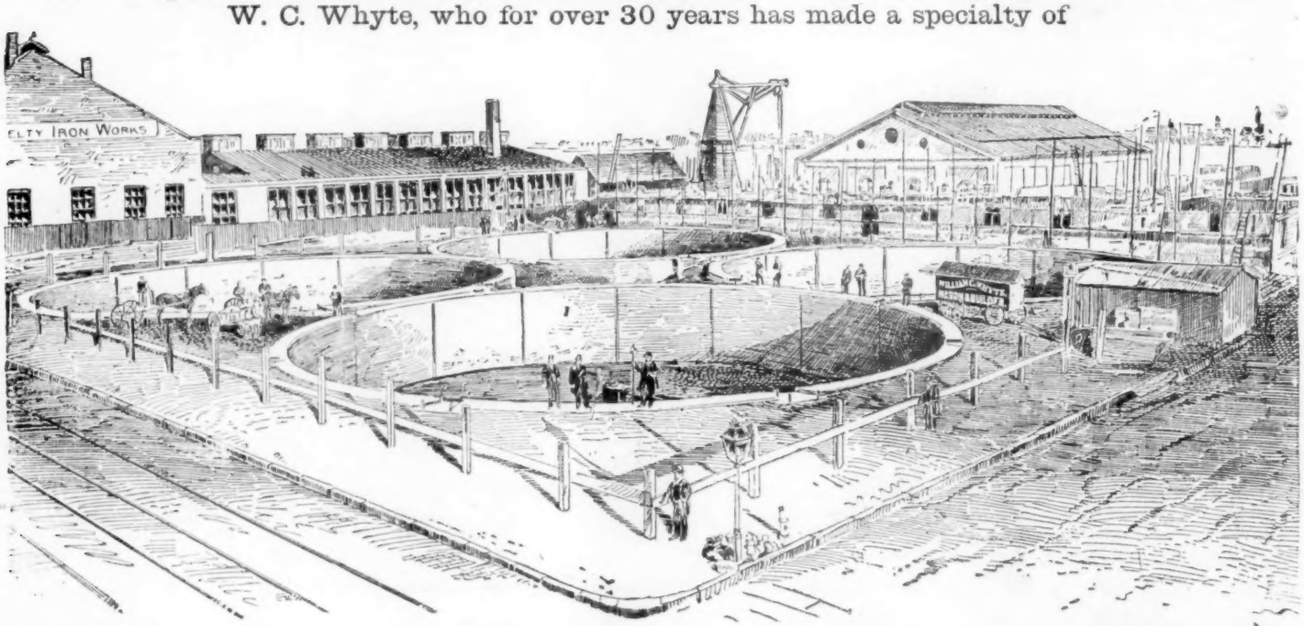

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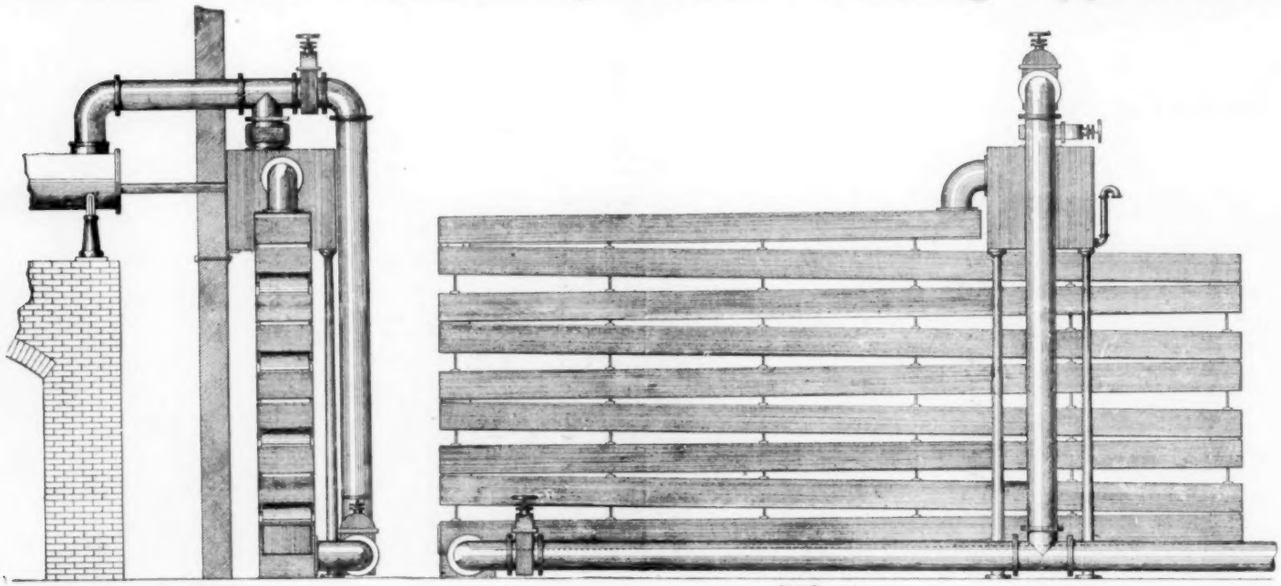

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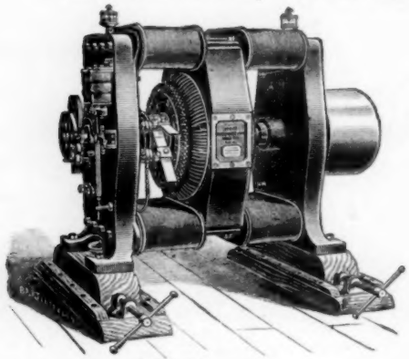

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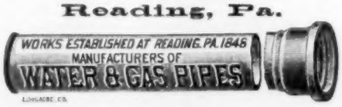

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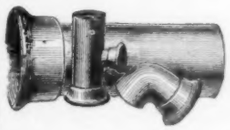

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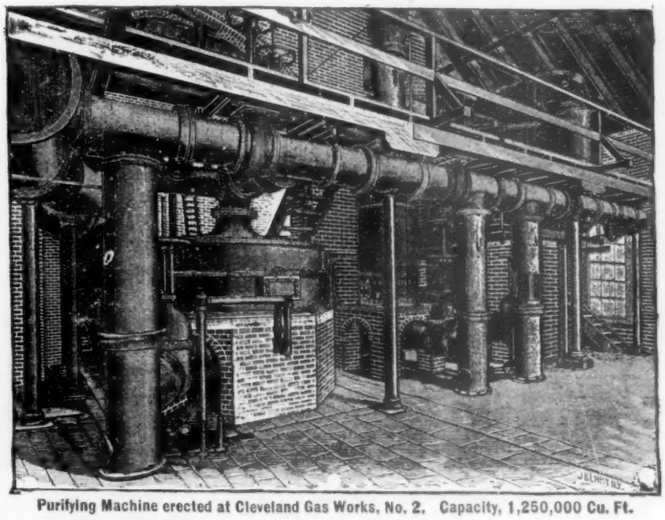

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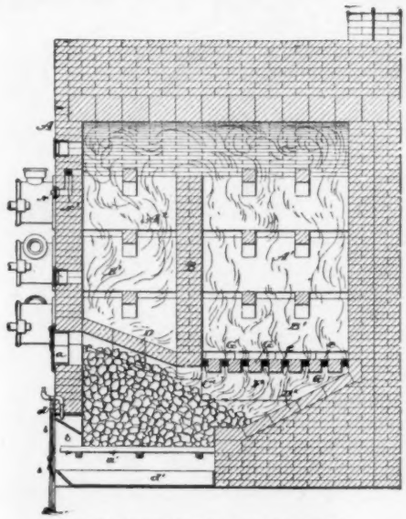

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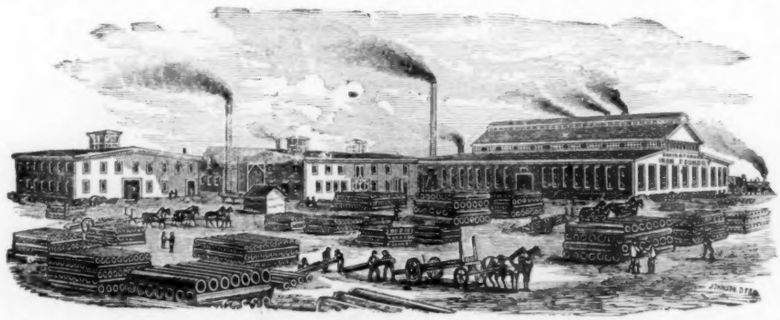

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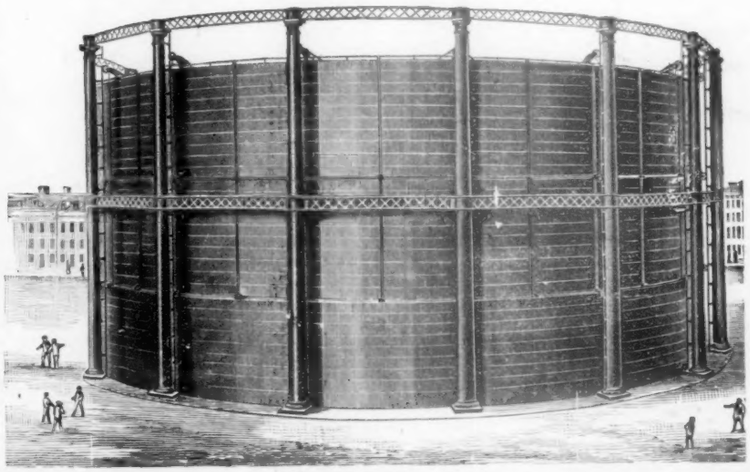

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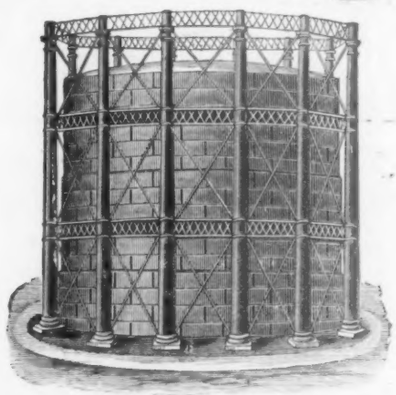

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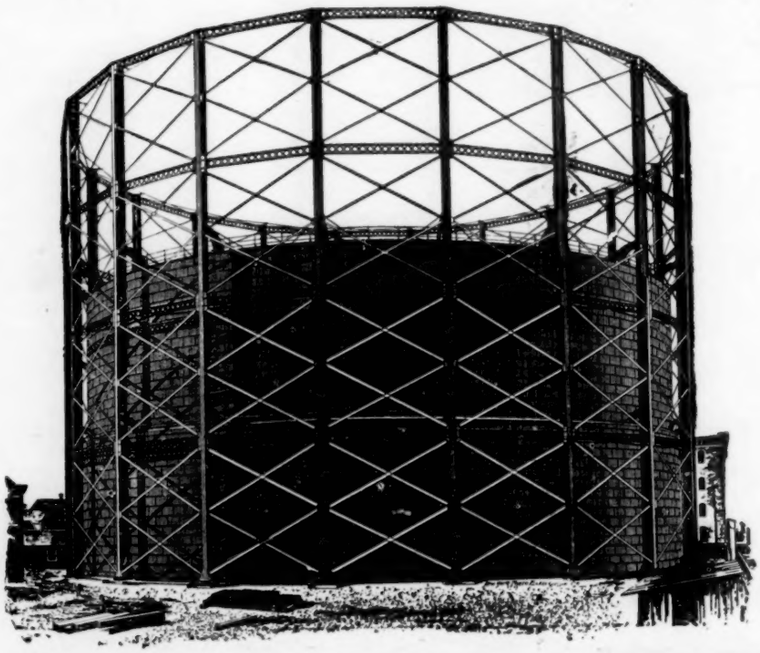

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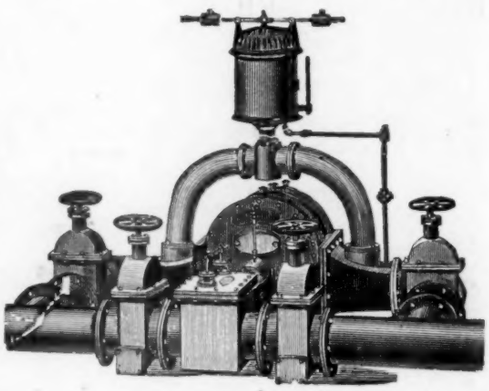

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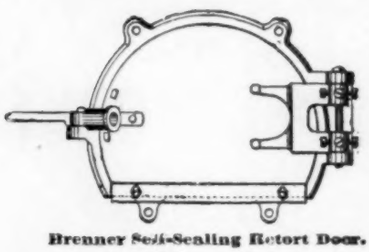

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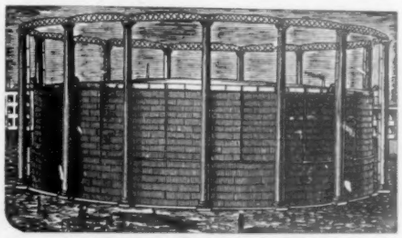
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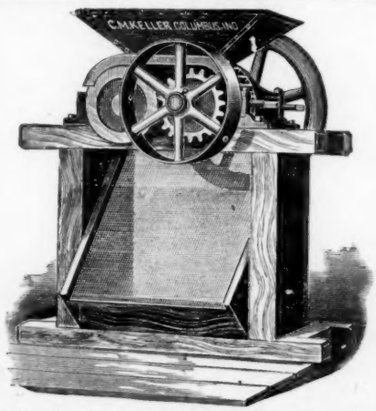

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GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

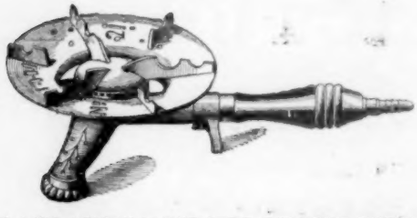
Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.



"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 3 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

½ [illegible] should be used where the pressure is 1 in. or over.